Kansas Energy Report 2005

Kansas Energy Council

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Energy Policy

The Kansas Energy Council is working towards development of a comprehensive, balanced energy policy to promote both increased production and reduced demand. Increased production will come from extending the life of existing Kansas energy resources, primarily oil and natural gas, and from developing new energy resources, the most attractive currently being coalbed methane, wind energy, and ethanol. Reduced demand will come from conservation and efficiency broadly applied across all energy sectors.

Energy Developments of 2004

Energy issues played a prominent role in Kansas in 2004.

- The value of the state's oil and natural gas production set a new record in excess of $3.3 billion and possibly as high as $3.5 billion for the year.

- Drilling for coalbed methane (natural gas from coal seams) continued at a fast pace, with substantial increases in gas production and revenues. Exploration expanded dramatically into northeastern Kansas.

- In electricity, the Federal Energy Regulatory Commission approved the formation of the Southwest Power Pool as a Regional Transmission Organization. Most Kansas utilities are members of this organization that covers parts of seven states.

- Electricity generation in Kansas is projected to increase 25% by 2009, while consumption should grow by 13%, ensuring adequate marginal capacity for reliability.

- At least 15 wind energy projects were in some phase of development, and late in the year agreement was reached to build a 150-MW wind farm in eastern Kansas, which would be the largest in the state.

- The debate over wind-energy development in the Flint Hills surfaced as one of the most contentious in the state.

- Ethanol production reached a new record in Kansas of 130 million gallons. With two new plants expected to be in operation in 2005, production is expected to reach 200 million gallons per year.

- The State Energy Resources Coordination Council (SERCC) was reconstituted in mid-year as the Kansas Energy Council (KEC), with an expanded mission, membership, and role as the principal energy planning and policy arm of state government.

Energy Forecasts

Consumption

Kansas energy consumption continues to increase, though it is expected to grow at a slower rate than during the past five years. While consumption of coal and petroleum products are projected to increase over this time period, natural gas consumption is expected to decrease in response to continuing high prices.

Kansas consumed 1,134 trillion Btu of energy in 2001, the last year of data from the U.S. Department of Energy, Energy Information Administration (Figure 1). Petroleum products account for the largest share of the state's consumption, with coal (used almost exclusively for electrical generation) coming in a close second. Energy consumption in Kansas for 2005, 2007, and 2009 is forecasted to be 1,222 trillion Btu, 1,258 trillion Btu, and 1,297 trillion Btu, respectively.

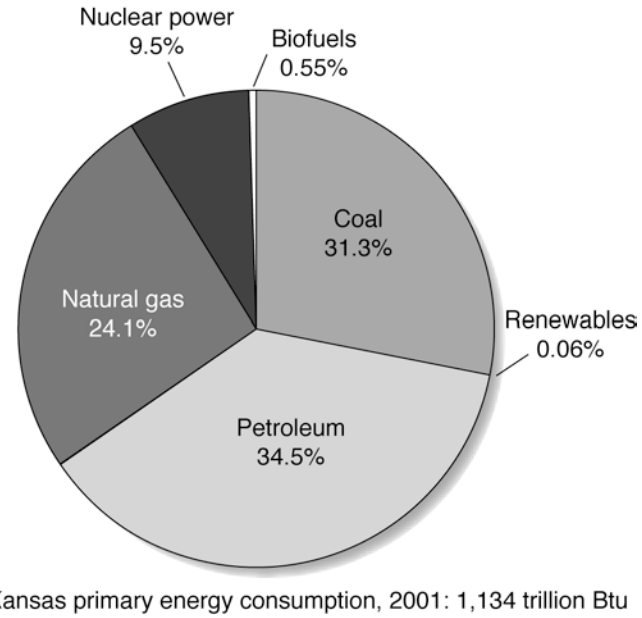

Figure 1—Kansas primary energy consumption, 2001.

Production

Kansas primary energy production in 2003 was 721 trillion Btu (Figure 2). Energy production in Kansas is expected to increase slightly over the next five years. In response to higher oil and gas prices, production of these resources is expected to level out or increase slightly. Ethanol and wind-energy production are expected to grow over this same period. For the years 2005, 2007, and 2009, the state's total energy production is projected to be 730 trillion Btu, 738 trillion Btu, and 740 trillion Btu, respectively.

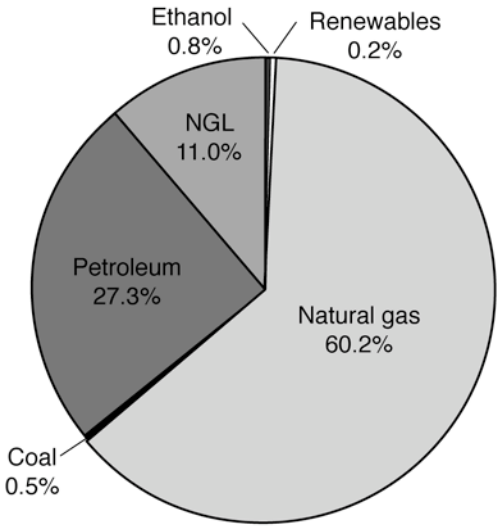

Figure 2—Kansas primary energy production, 2003. Primary energy production does not include electricity from nuclear- or fossil-fuel-generated power plants because those fuels are imported from outside the state.

Kansas Energy Council Recommendations

The Council's recommendations for 2005 include items that require action by the legislative or executive branch of state government, as well as activities that the Council itself will pursue. Except where noted otherwise, the recommendations were approved unanimously.

Legislative Action

1. Amend Article 9 of the Uniform Commercial Code to restore a priority creditor status for sellers of oil and gas production when a purchaser is in bankruptcy. Such an amendment would follow the language of the former K.S.A. 84-9-319, which was repealed in 2000. *[11 in favor, 5 opposed]*

2. Authorize the Kansas Development Finance Authority (KDFA) to offer bonds to finance Kansas energy projects.

3. Remove mandatory labeling for 10% ethanol mixtures at the gas pump. Rescind Subsection b of Kansas Statute No. 79-3408, which currently requires that retail gasoline pumps with ethanol blends be labeled. *[11 in favor, 6 opposed]*

4. Adopt a $0.005/kwh production tax credit for new renewable energy facilities or expansions of existing facilities, including wind, hydro, solar, and biomass. This credit should be for the first 10 years of the facilities' operation, be tradable to allow benefit to non-taxable entities, and designed in such a way that it is transparent who claims these and how much they claim. *[15 in favor, 1 opposed]*

5. Adopt language clarifying that negotiations and discussions between wind-energy developers and local governments regarding voluntary payments for wind projects are legal.

Executive Action

1. Encourage producers and the Kansas Department of Revenue to study the advantages of changing the basis for the severance tax exemption on natural gas production from a dollar-based exemption level to a volume-based exemption level.

2. Encourage the Kansas Development Finance Authority (KDFA), as authority permits and as determined appropriate, to assist refiners and utilities in obtaining financing for refinery and utility modifications in compliance with EPA requirements.

3. Encourage the development of a Memorandum of Understanding to improve regulatory cooperation among appropriate state regulatory agencies and the U.S. Environmental Protection Agency in order to promote protection of the environment in a cost-effective manner, minimize regulatory duplication between the state and national levels of government, and increase efficiencies and communication for the "downstream" parts of the petroleum industry (i.e., refining and marketing).

KEC Action

1. Direct a team to enact a study of the economic, environmental, and energetic effects associated with the enactment of a statewide Renewable Portfolio with Tradable Energy and Environmental Credits.

2. Study the costs and benefits of implementing a public benefit fund to support strategic energy activities in Kansas, and options to fund it.

3. Develop a comprehensive, long-range strategic plan that includes tasks, resources, and intermediate steps necessary to meet the KEC objectives outlined in Executive Order 2004-05. This process would also involve determining what energy programs currently exist in state agencies and examining options for funding mechanisms for the KEC and other energy activities.

4. Develop a comprehensive energy efficiency and conservation agenda for KEC and determine how it should be implemented.

Kansas Energy Overview

Kansas Energy Policy

Kansas needs a comprehensive, balanced energy policy to promote both increased production and reduced demand. The close tie between energy and the Kansas economy was recognized in the Statewide Economic Revitalization Plan of 2003 and the Rural Life Task Force report of 2004. Developing a statewide energy policy was identified as an essential component of a robust state economy.

Such a policy would have to address key components of the Kansas energy mix, including (1) developing new energy sources, especially wind, biomass (ethanol), and coalbed methane (natural gas from coal seams); (2) using new techniques to extend the life of existing energy resources, primarily oil and gas fields; (3) increasing energy efficiency and conservation; and (4) expanding the state's energy infrastructure. Increased production comes from extending the life of existing Kansas energy resources and from developing new energy resources. Reduced demand will come from conservation and efficiency broadly applied across all energy sectors.

Energy planning in Kansas is presently carried out in a piecemeal approach, driven in large part by exigencies and individual initiatives among Kansas Energy Council (KEC) members and other energy stakeholders. As of yet, there is no comprehensive, integrated plan to achieve the goals outlined in the executive order that created the state energy council (Appendix 1). One of KEC's ongoing tasks will be to ascertain what Kansas needs for effective energy policy and planning and implement those results.

Energy policy is too critical to be left to chance. One only has to compare energy planning to water planning in Kansas to see the problem. An array of state and local agencies, boards, and programs deal with water issues in a comprehensive way. The Kansas Water Office, with a good-sized staff of fulltime water experts and professionals, supports the Kansas Water Authority and a multi-million budget to coordinate and implement a coordinated state water plan. Energy planning, in contrast, is carried out by the KEC, an appointed group with minimal staff and budget.

The lack of an integrated, comprehensive energy plan is also evident within state government, where a variety of energy-related programs and activities are spread among different departments and agencies, not coordinated, nor, in some cases, even aware of the other programs. Expenditures of state resources on energy issues are not consciously prioritized or coordinated.

Executive Order 2002-04, which created the original State Energy Resources Coordination Council, specified several tasks, including that of making Kansas energy self-sufficient and an energy exporter. The council, recognizing that energy self-sufficiency, in and of itself, might not be in the best economic interests of the state, adopted the following as an additional goal: *to help ensure Kansans have low-cost, reliable, and sustainable energy, produced in-state to the fullest extent possible.* Executive Order 2004-05 formally incorporated this latter goal for the reconstituted Kansas Energy Council.

Net Energy Balance

The 2003 Kansas Energy Plan received widespread attention for first reporting that Kansas had become a significant net energy importer in recent years. Public debate continues over the consequences of that change in the state's economic status. The KEC, however, recognizes that low-cost, reliable, and sustainable energy is critical to the state's overall economic well-being and that becoming self-sufficient in energy (or even an energy exporter), in and of itself, is not necessarily in the state's best interests.

Kansas exports a variety of products, such as corn, wheat, beef , and airplanes, because we can produce them cost effectively. We import many other products that are not as easily produced locally. As long as the state can produce energy at competitive prices for in-state use and for export, it is beneficial to do so. The Kansas energy economy today is dramatically different from that of even two decades ago. By pointing out that Kansas is now a net energy importer, it is our intent to help Kansans better understand the changing role of energy in the economy and the consequences of policy decisions affecting energy.

Kansas continued to import a record amount of energy in 2004. This trend, which began in 1997, is expected to grow through 2009, though at a slower rate than during the last several years (Figure 3). Despite an upsurge in oil and gas production, stemming declines of recent years, and growth of ethanol and wind energy, energy consumption in Kansas is expected to continue to outpace production.

Net energy imports in 2004 are estimated to be 479 trillion Btu, about 30 trillion Btu greater than in 2003. The estimated cost of net imports for 2004 is $1.89 billion. By 2009, the state's net energy imports are expected to increase to 557 trillion Btu, which could be valued at $2.2 billion, using today's prices.

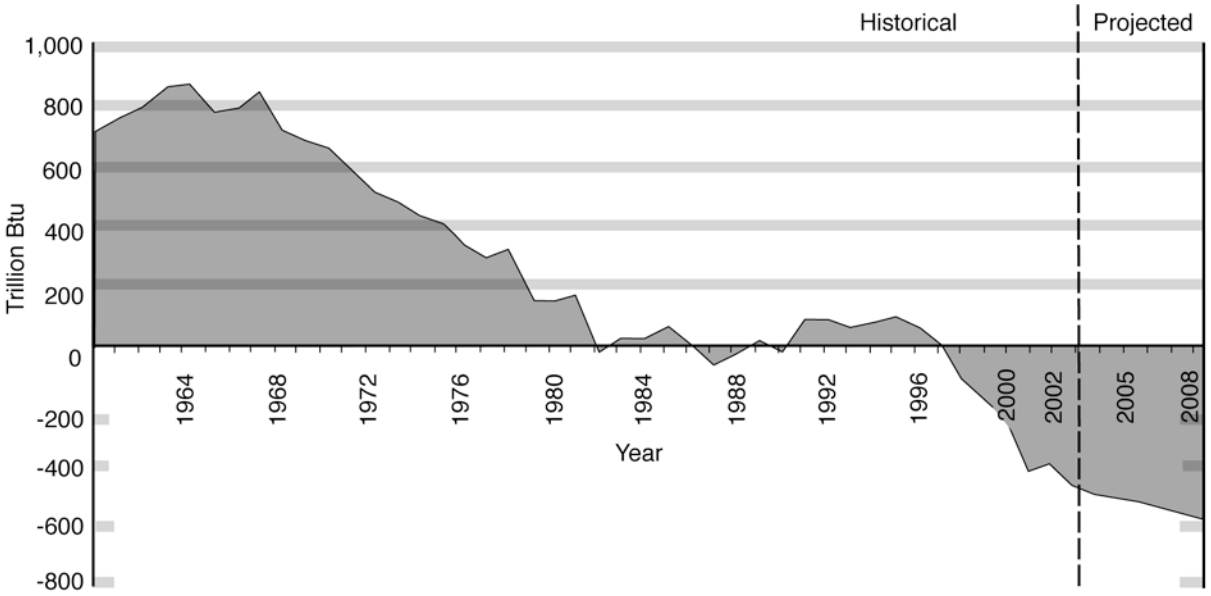

Figure 3—Kansas net energy balance, 1960 to 2003, with projections to 2009. Positive numbers show energy produced in excess of consumption (exports), while negative numbers show energy consumed in excess of production (imports).

Wind Energy

Kansas' wind-energy potential ranks somewhere between first and third in the nation[1] and is at least 10 times greater than the state's current electrical demand. Midwestern states, including the Great Plains, have enough potential in their windiest sites alone to meet the entire nation's electricity needs.[2] Should Kansas or any of the Plains states choose, electricity from wind power could become another exportable resource, much like grain, beef, and airplanes.

However, the state's wind-energy potential remains largely untapped. At present, eleven other states have more installed wind-generation capacity than Kansas.[3] Currently, the Gray County Wind Farm, near Montezuma, is Kansas' only utility-scale wind farm (Figure 4). This 112-megawatt wind farm, with enough generating capacity to power 33,000 homes, is owned and operated by FPL Energy of Juno Beach, Florida, and began generating electricity in late 2001. It currently provides 5.5% of the total power consumed by Aquila's Kansas customers.[4] Based on its first two years of operation, the Gray County Wind Farm's capacity factor (the percentage of time that the wind turbines generated electricity) averaged about 40%[5], which is one of the highest capacity factors at a wind-energy facility in the nation.

No new wind farms were built in 2004, largely due to the expiration of the Federal Production Tax Credit (PTC) on December 31, 2003. At least fifteen wind farms are in some phase of development within the state, some of which could be constructed in the next several years (Figure 4, Table 1).

Half of these proposed projects fall within the Flint Hills region and have been a source of controversy. The Flint Hills includes the last large tract of untilled tallgrass prairie in North America. The region also has an excellent wind resource in proximity to Kansas' major population centers and large transmission lines. The controversy led Governor Kathleen Sebelius to ask the energy council to form the Wind and Prairie Task Force (WPTF) in December 2003. The WPTF met from January to May 2004 and delivered its final recommendations to the Governor on June 7 (see page 28 for additional discussion of the WPTF activities).

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[1]Kansas is ranked third behind Texas and North Dakota in D.L. Elliott and M.N. Schwartz, 1993, Wind Energy Potential in the United States: Pacific Northwest Laboratory Report PNL-SA-23109 (September 1993). It is ranked first in a more recent study by the U.S. Public Interest Research Group—Generating Solutions: How Clean, Renewable Energy is Boosting Local Economies and Saving Consumers Money (April 2003).

[2]Elliott and Schwartz, 1993; and GAO, 2004, Wind Power's Contribution to Electric Power Generation and Impact on Farms and Rural Communities: United States Government Accountability Office, Report GAO-04-756, September 2004, p. 17. These areas include those of Class 4 or greater wind potential and exclude 100% of urban areas, 100% of environmentally sensitive areas (such as parks and preserves), 50% of forest lands, 30% of agricultural lands, and 10% of range lands. The original study assumed wind turbine hub heights of 30 meters; today's wind turbines have hub heights between 60 and 80 meters.

[3] American Wind Energy Association's Wind Energy Projects as of Jan. 22, 2004: http://www.awea.org/projects/index.html.

[4] Largest Kansas Wind Farm Reaches Milestone in Providing Power for Aquila Kansas, Missouri Customers: Business Wire, November 22, 2004.

[5] U.S. Department of Energy, Energy Information Administration (EIA), 2004, Form EIA-906 and EIA-920 Databases: http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html.

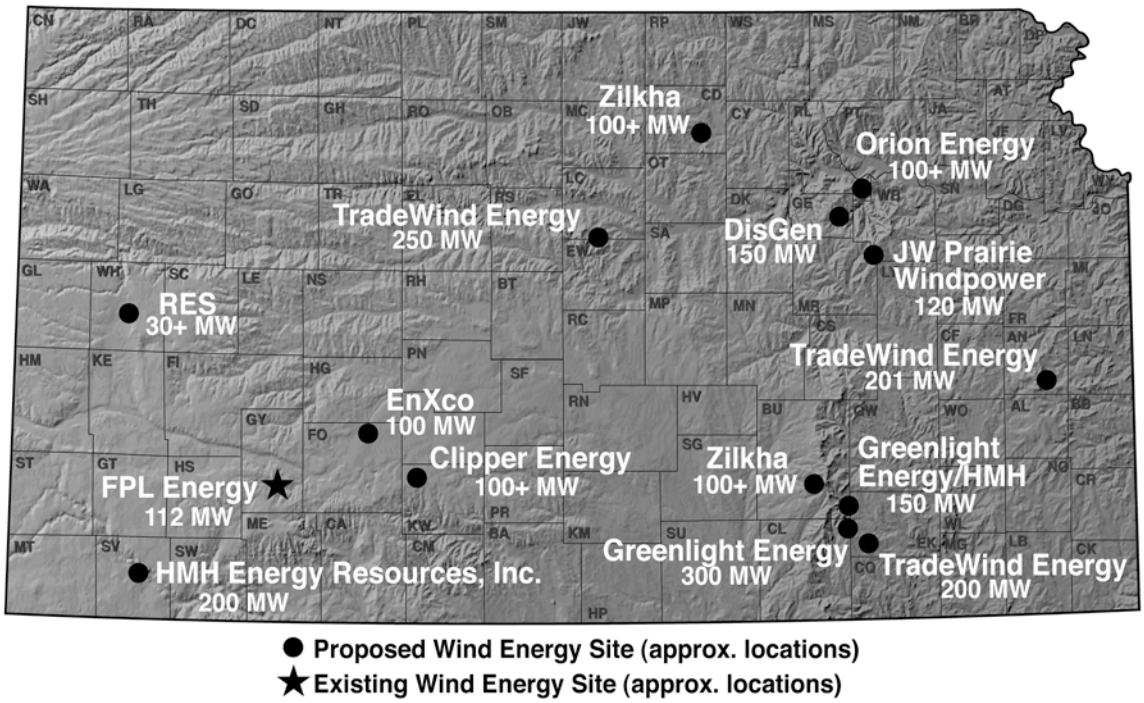

Figure 4—Existing and proposed wind-energy projects in Kansas, as of December 2004.

The broad recommendations in the WPTF final report included developing better maps of the untilled prairie, implementing a tourism plan for the Flint Hills, utilizing WPTF guidelines for siting wind farms and for negotiating leases with landowners, and seeking options to expand electrical transmission lines to western Kansas. All of these recommendations have been acted upon in some manner by the KEC, its staff, and other State agencies.

During this process, the Governor asked utilities and wind developers to exercise restraint within the Flint Hills. Improved maps of untilled prairie were completed in October by researchers at the Kansas Biological Survey. The next month the Governor's Natural Resources Sub-cabinet recommended restraint on development of wind farms in a proposed "Heart of the Flint Hills" area, bounded by highways (U.S.-400 to the south, U.S.-77 to the west, U.S.-24 to the north, and K-99 and K-4 to the east) until (1) local governments develop siting guidelines for wind energy, (2) the Department of Commerce, Division of Travel and Tourism completes an economic development assessment of the Flint Hills that includes an assessment of the impact of wind energy, and (3) the state prepares a funding package from government and private sources to pay for conservation easements in the Flint Hills. The Governor's final decisions on these and other recommendations on this topic are pending, in part on the recommendations contained in this report.

Table 1—Proposed Kansas wind projects by developer, location and size, 2004.

Project Name	Developer	County	Size (MW)
British Pastures Wind Farm	Orion Energy	Riley	100
Caney River Wind Farm	TradeWind Energy	Elk	200
Chase County Wind Farm	FPL Energy	Chase	100+
Cloud County Wind Farm	Zilkha Renewable Energy	Cloud	100-150
Conestoga Wind Project	HMH Energy Resources, Inc.	Stevens	200
Deer Creek Wind Farm	TradeWind Energy	Anderson	200
Elk River Wind Project	HMH Energy Resources, Inc./ Greenlight Energy, Inc./ PPM Energy, Inc.	Butler	150
Elk River Wind Project II	Greenlight Energy, Inc.	Cowley/Elk	200-250
Geary County Wind Ranch	DisGen Energy	Geary	100
Kiowa County Wind	Clipper Windpower, Inc.	Kiowa	100+
Munkers Creek Wind Farm	JW Prairie Windpower LLC	Morris	100-150
Rosalia Wind Farm	Zilkha Renewable Energy	Butler	100+
Smoky Hills Wind Farm	TradeWind Energy	Lincoln/Ellsworth	150-250
Spearville Wind Project	EnXco, Inc.	Ford	100
Sunflower Electric Wind Farm	Renewable Energy Systems (RES)	Wichita	30

In December 2004, Empire District Electric (EDE), signed a contract with PPM Energy, Inc., to purchase 150 MW of wind power. EDE serves parts of southeast Kansas and adjacent areas in Missouri and Arkansas. PPM will build and operate the Elk River wind project in Butler County, near Beaumont, and expects to be generating electricity by December 1, 2005. EDE plans to purchase about 550,000 megawatthours of electricity annually from the facility. The Elk River project is located to the south of the proposed "Heart of the Flint Hills" area.

Although the potential for further wind development in western Kansas remains high, aggressive development of this potential is limited by the lack of sufficient transmission capacity to carry excess electricity from the western half of the state to markets in the east. The incompatibility of the Kansas electric grid with that in Colorado effectively cuts off the potentially large market for wind-generated electricity in Denver and eastern Colorado or elsewhere in the western grid.

Several wind projects are proposed for western Kansas, but only one project has indicated it will be built in 2005, the 30-MW Sunflower Electric Wind Farm near Marienthal.[6] By renewing the federal PTC only through December 31, 2005, Congress created a high demand for wind turbines, resulting in higher turbine prices as well as warnings from manufacturers that orders

[6] Bob Johnson, Sunflower Electric, personal communication, October 28, 2004.

made after December 31, 2004, may not be filled by the end of 2005. Because of these constraints, only a couple of the proposed wind projects—which have cleared the necessary local hurdles, been sufficiently studied and approved by the Southwest Power Pool, and obtained a power purchase agreement with an electric utility—can be built in this time frame. If Congress extends the PTC beyond 2005, other projects may be completed. In October, Governor Sebelius called for extension of the PTC for at least another year. This call is being picked up and repeated by other leaders, including former U.S. Secretary of Energy and current Governor of New Mexico Bill Richardson.

In addition to utility-scale projects, mid-scale wind-energy development (1 to 20 MW) by municipalities, schools, rural cooperatives, and farmer-investor partnerships could also play an important role and needs to be considered in statewide energy planning. Several other Midwestern states are taking this approach, most notably Minnesota and Iowa. These mid-scale projects can go forward in areas where current transmission constraints rule out larger projects. Mid-scale developments are often owned by local or in-state entities, thus providing considerably more jobs and income to local communities than projects owned by out-of-area firms.[7]

Small-scale wind-energy developments (typically up to 1 MW) generally involve an individual or company producing energy for their own needs. While there are dozens of small wind-turbines in operation throughout Kansas, this market is limited by higher per-unit costs. Currently, Kansas offers no incentives specifically for small-scale wind-energy development.

For the wind industry to reach its full potential in Kansas, several things would need to be done. In the short-term, Congress should extend the Federal PTC for more than the recent 15-month period, allowing projects to be negotiated and developed in a less frantic manner and creating some stability within the industry. The Kansas Legislature should adopt an additional State PTC to keep the state competitive with other nearby states, such as Oklahoma (see KEC Recommendations, p. 28), and consider whether new incentives are necessary to help the mid-scale and small-scale projects compete economically. While wind development is first and foremost energy production, the economic benefits to rural communities where they are built should continue to be factored into the equation.

Biomass Energy

Biomass is any organic material derived from plants and animals. All biomass contains carbon, just as coal and petroleum do, and can be used as a renewable energy source to heat homes and businesses, power automobiles and trucks, and produce electricity.
Biomass energy (bioenergy) is produced through burning, gasification, and chemical processes. In gasification, biomass is heated in a low-oxygen environment and converted into a gas that can be used to power devices such as combustion turbines or fuel cells to generate electricity. Chemical processes used to convert biomass to energy include fermentation, used to produce ethanol (see discussion below), pyrolysis, used to produce liquid oil, and transesterification, used to produce biodiesel.

[7] GAO, 2004, p. 78, 82, 83.

The state of Kansas has an abundance of biomass resources that can be used to produce energy and fuels (Table 2). When used for generating electricity, biomass resources such as switchgrass and wood wastes are typically burned to transform water into steam to drive turbines attached to electrical generators. Biomass can also be used for co-firing, a process in which small amounts of biomass (5–15% by heat content) are combusted with coal in traditional coal-fired generating units. This practice reduces the quantity of coal consumed, resulting in lower levels of pollution emissions and has been adopted by major utilities in Iowa and Wisconsin.

Table 2—Kansas Biomass Resources and Potential End Uses.

Biomass Resources	**Energy End Uses**
Herbaceous energy crops	
Switchgrass	bioethanol, electricity
Big bluestem	bioethanol, electricity
Poplar	bioethanol, electricity
Black locust	bioethanol, electricity
Agricultural crop residues	
Corn stover	bioethanol
Wheat straw	bioethanol
Bagasse (sugar cane waste)	bioethanol, heat, electricity
Wood waste	
Sawdust	heat, electricity
Chips, waste boards	heat, electricity
Tree trimmings	heat, electricity
Oilseed crops (soybeans, sunflower)	biodiesel
Edible and inedible tallows	biodiesel
Waste greases	biodiesel
Landfill gas	heat, electricity
Grain dust	heat
Animal manures	heat, electricity

Animal manures are commonly used to produce low-grade methane gas by placing them in a storage tank devoid of oxygen and allowing them to decompose. The decomposition process generates methane gas and also produces a sludge, which can be used as a nutrient supplement for agricultural cropland. This process is referred to as anaerobic digestion. Anaerobic digesters are common at large-scale dairies and swine operations.

Corn stover, wheat straw, and switchgrass can be used to produce bioethanol, which is similar to ethanol derived from corn grain and grain sorghum. The corn stover, wheat straw, and switchgrass are converted to sugars that are fermented into ethanol. Using switchgrass as a feedstock, instead of conventional commodity crops, has major environmental advantages, including decreased sediment and nutrient transport to streams, lakes, and reservoirs because switchgrass is much better at holding the soil and nutrients in the field during periods of intense rainfall.

Oils, fats, and waste greases can be converted into a substitute diesel fuel called biodiesel through the use of a chemical conversion process called transesterification. This biodiesel can then be mixed with conventional diesel fuel or used by itself. Biodiesel is a cleaner burning fuel that provides significantly better environmental and health benefits compared to conventional diesel fuel.

Ethanol

Ethanol, also known as ethyl alcohol or grain alcohol, is the most widely used biofuel today. It is primarily used as a fuel additive to improve performance and reduce air pollution. In 2003, U.S. ethanol production increased 32% from the previous year to 2.81 billion gallons. The ethanol industry estimates that the 82 facilities nationwide currently have a production capacity of about 3.5 billion gallons. With at least 10 additional facilities under construction, annual production capacity is forecast to grow to 5 billion gallons over the next several years.

Although ethanol represents just over 1% of U.S. transportation fuel consumption, it has become an ubiquitous gasoline component, valued for its octane and oxygen content. Containing 35% oxygen by weight, ethanol improves the combustion of petroleum fuels, thereby reducing harmful tailpipe emissions of carbon monoxide (CO), particulate matter (PM), oxides of nitrogen (NOx), and other ozone forming pollutants. At the same time, being highly degradable, ethanol does not pose a threat to water supplies as do some other gasoline additives.

Given its desirable environmental profile, ethanol has been utilized in both the federal reformulated gasoline (RFG) program, designed to reduce summertime smog, and the federal winter oxygenated fuels program that combats harmful CO pollution. Ethanol is now the most widely used oxygenate in both of these clean air programs. Numerous studies have highlighted the environmental advantages of biofuels in combating greenhouse gas emissions.[8]

Ethanol is commonly produced from feedstocks such as corn, milo, oats, barley, and wheat in a fermentation process similar to that used to brew beer. Ethanol can also be produced from cellulosic feedstocks such as agricultural and forestry residues and waste materials. Several companies are moving towards commercial production of this kind of ethanol, also known as bioethanol.

Ethanol production in Kansas increased roughly 60% in 2004, with the state's six plants producing 130 million gallons of ethanol, while employing 200 people and creating a market for 50 million bushels of grain. Of the 130 million gallons of ethanol annually produced in Kansas, roughly 40 million gallons is consumed in-state, with 4–5% of Kansas fuel containing ethanol.

A new plant, with an annual capacity of 35 million gallons, is under construction in Garnett and is expected to come online in May 2005 (Figure 5). This will boost statewide production to roughly 165 million gallons. A similar-sized plant is planned for 2005 construction in Phillipsburg in Phillips County, where equity fundraising is underway. Several other Kansas

[8] See, for example, David L. Green and Andrea Shafer, 2003, Reducing Greenhouse Gas Emissions from U.S. Transportation, prepared for the Pew Center on Global Climate Change (May 2003).

communities are in various stages of planning for new ethanol plants, and at least two involve the use of cellulosic feedstocks such as corn stover and wheat straw.

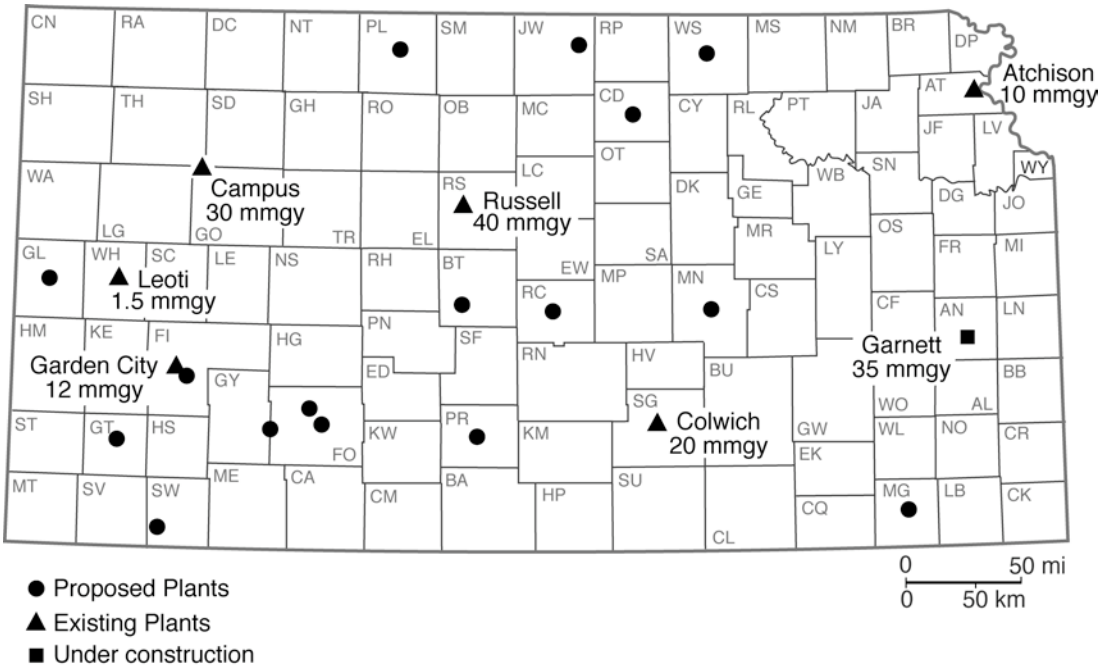

Figure 5—Existing and proposed ethanol plants in Kansas, as of December 2004. Production capacity is noted in million gallons per year (mmgy).

Solar Energy

Solar energy, power from the sun, is free and inexhaustible. In the broadest sense, solar energy supports all life on earth and is the basis for almost every form of energy we use. The sun makes plants grow, which are burned as fuel or rot in swamps where they are compressed underground for millions of years to become coal and oil. Heat from the sun causes temperature differences between areas, causing the wind to blow. Water evaporates because of the sun, falls on high elevations, and rushes down to the sea, spinning turbines as it passes.

The amount of solar energy that falls on the earth is enormous. All the energy stored in the earth's reserves of coal, oil, and natural gas is matched by the energy from 20 days of sunshine. Outside the earth's atmosphere, the sun's energy contains about 1,300 watts per square meter. About one-third of this light is reflected back into space, and some is absorbed by the atmosphere (in part causing winds to blow). By the time it reaches the earth's surface, the energy in sunlight has fallen to about 1,000 watts per square meter, at noon on a cloudless day. Averaged over the entire surface of the earth, 24 hours per day for a year, each square meter collects the energy equivalent of about a barrel of oil. So each day, on average, a square meter collects 4.2 kilowatthours (kWh) of energy.

Solar insolation is the amount of electromagnetic energy (solar radiation) received on the surface of the earth. In Kansas, daily solar insolation ranges from 3.5 kWh per square meter in the

northeast part of the state to nearly 5 kWh per square meter in the southwest corner. For the entire state, annual solar insolation is equal to approximately 1,000 times the state's annual fossil and nuclear energy consumption. As a renewable energy source, solar energy can be used for heat, lighting, and electricity (Figure 6).

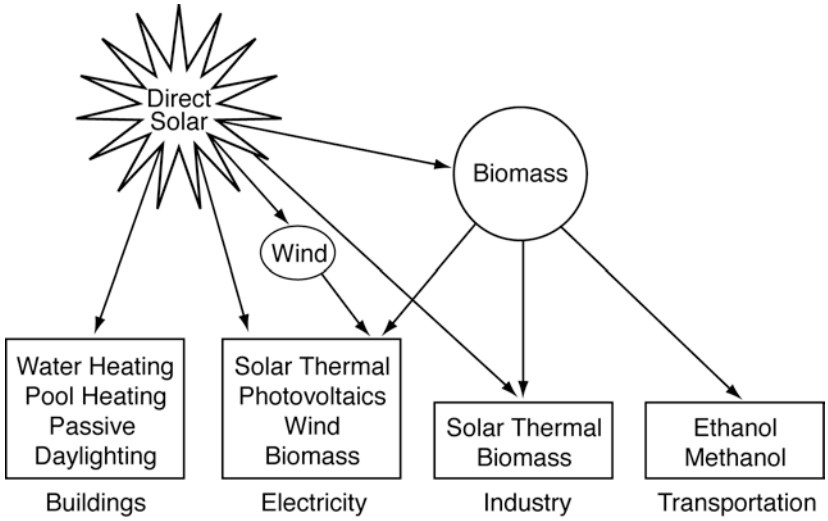

Figure 6—Solar-generated energy sources and uses.

The primary systems and direct uses of solar energy are:

- Photovoltaics (PV) convert sunlight directly into electricity using PV cells made of semiconductor material. Flat-plate PV collectors are often used for residential and commercial building applications and can also be used in large arrays for utility applications.
- Concentrating Solar Power (CSP) systems concentrate the sun's energy using reflective devices, such as troughs or mirror panels, to produce heat that is used for industrial processes or to generate electricity. These are typically mounted on tracking systems in order to always face the sun, allowing them to capture the maximum amount of direct radiation. Concentrating systems are generally used for village-scale or grid-connected utility systems.
- Solar water-heating systems either heat water directly or by heating a "working fluid" that then heats the water. Solar water heaters are commonly used in homes; in swimming pools, spas, and hot tubs (a particularly cost-effective application); or in industrial processes.
- Transpired solar collectors use solar energy to preheat ventilation air for buildings. Air is pulled through the perforated collector plate by a fan and then pulled into the building. Transpired collectors are ideal for industrial and commercial buildings with large ventilation requirements.
- Passive solar energy designs use the building itself as both the solar collector and storage medium, usually by increasing the window area on the south side of the building and the amount of thermal mass inside the building to absorb the solar heat that enters through the windows.
- Daylighting systems maximize light during the day, significantly reducing the cost of, and heat gain from, electric lighting.

Depending on the particular solar technology used, Kansas has good solar resources throughout the state, with excellent regions in the southwestern and western parts of the state. Cost-benefit evaluations for solar applications will account for current and future conditions, and should be conducted to determine the most appropriate system size and configuration. Passive solar and daylighting applications are very cost effective in all areas.

For example, in western Kansas, a flat-plate PV array with a collector area the size of a football field would produce around 1,106,000 kWh per year, or enough to energy to power 111 average homes. In an optimal southwestern Kansas location, a solar trough electricity system with a collector area of 200,000 square meters—a system that would require a gross land area of roughly 150 acres—would produce about 47,421,000 kWh per year, or enough to power 4,759 homes. However, because U.S. cities and residences cover about 140 million acres of land, the nation's current electricity requirements could be met simply by applying PV to 7% of this area—on roofs, on parking lots, along highway walls, on the sides of buildings, and in other dual-use scenarios.

A typical Kansas home with a 200 square foot PV roof array could meet up to 30% of its annual electricity consumption. Because solar PV produces the most energy during the summer, such a PV array would reduce peak demand on utility systems. Average costs for 2 to 3 kilowatt PV-grid connected systems are currently about $10/watt installed.[9] The distributed generation of electricity through solar PV will require policy and infrastructure change to become a competitive energy source in Kansas.

Energy Efficiency and Conservation

Nearly a century of cheap, generally abundant fossil fuels has allowed Kansans to construct an economy and infrastructure that are far less efficient than they could be, given current knowledge and technology. The dramatic increases in natural gas and oil prices during the past two years underscores the importance of energy efficiency and conservation.

Reducing the demand for energy by reducing consumption has many benefits beyond simply reducing energy use. Each Btu of electrical energy saved by the end user reduces energy consumption by over 3 Btus at the power plant because power plants on average operate at approximately 32% efficiency.

Reducing the demand for energy also has environmental benefits. For each kilowatthour (kWh) of electricity used in Kansas, power plants emit almost 2 pounds of CO_2, 4 grams of SO_2, and 7 grams of NO_x. Kansas households consume, on average, approximately 780 kWh each month.

Kansas has great potential for improving energy efficiency in homes and businesses. If, for example, Kansas homes were built to meet the thermal-efficiency standards recently adopted for new commercial and industrial structures, energy use in those homes for heating would be reduced by over 25% and cooling energy by 17%. If new, commonly available, high-

[9] Jagmeet S. Kaholn, Joseph McCabe, and Tony Brasil, 2003, Analysis of PV System Cost Trends from the California Energy Commission's Emerging Renewables Program, California Energy Commission Public Interest Energy Research–Renewable Section (1516 9th St., MS 43, Sacramento, CA 95814).

performance heating and cooling systems were used in combination with these energy code requirements, energy savings would increase to 35% for heating and 30% for cooling. These opportunities involve common, well-understood construction techniques, materials, and equipment, not cutting-edge technology.

Energy-saving home appliances are readily available and represent another area for improving energy efficiency. In 1997, residents of the northeast Kansas town of Bern participated in a U.S. DOE-sponsored demonstration project, trading in their washing machines for new front-loading machines. The performance of these Maytag Neptune washers was measured by DOE's Oak Ridge National Laboratory in a five-month study that analyzed data from 20,000 wash loads: on average, the new machines used 56% less energy and 38% less water than the machines they replaced.[10] Similarly, replacing 10-year-old refrigerators with high-performance models saves 50% of the energy used to operate them. Compact fluorescent lamps provide the same amount of light as incandescent lamps, while using five times less energy and lasting 10 to 15 times as long.

Almost all existing homes have opportunities for energy savings. Simple weatherization efforts (increasing insulation, adding storm windows) result in significant savings, from 23% to 30% of heating costs. Nationally, lighting accounts for 44% of office and 56% of educational buildings' energy use. Fluorescent lighting, long the mainstay for schools and offices, has undergone a renaissance, using 40–50% less energy than those common in buildings built just 15 years ago. The cost of these upgrades is typically paid for in less than four years by energy savings.

Although Kansas has great potential for energy efficiency and conservation, its support of such activities remains essentially limited to the programs and activities funded through grants from the State Energy Office (SEO), which is funded with oil overcharge funds from the U.S. Department of Energy. These projects include the energy outreach activities of KSU Energy Extension Service (EES), which answers 400 to 500 consumer energy questions annually, produces a weekly energy Q and A column for Kansas newspapers, and conducts public education through meetings and media outlets up to 20 times a year. A web site (http://www.engext.ksu.edu/ees/welcome.htm) with fact sheets is updated and available with advice on ways to reduce energy use in homes and small businesses.

Another program, the Facilities Conservation Improvement Program (FCIP), helps develop individualized plans for energy conservation improvements, using utility bill savings as collateral to finance energy conservation measures. The program includes unified school districts, cities, counties, municipal hospitals, state colleges and universities, and all state agencies. The savings generated during the projects themselves fund the FCIP. Any of the many private energy service companies (known as ESCOs) that do energy audits of buildings guarantees annual energy savings, which are then used to pay off the traditional financing. Once the loan or bond has been paid off, all future energy savings accrue to the organization and taxpayers (in the case of government funded entities).

The Kansas Weatherization Assistance Program (K-WAP) helps low-income families make home repairs that are expected to lower their energy bills. K-WAP targets households that

[10] U.S. Department of Energy, Energy Efficiency and Renewable Energy, 2002, Kansas Town Demonstrates Water and Energy Savings with Washers: EERE News, October 2002 (http://www.eere.energy.gov/news/archive.cfm).

include elderly people, persons with disabilities, and families with children. In addition, the program may target households with a high energy burden (that is, a larger percentage of their income is used for energy bills) or with high energy usage. The 2003 Kansas Weatherization Program year (April 1, 2003 through March 31, 2004) was funded by the U.S. Department of Energy and the Low-Income Home Energy Assistance Program (LIHEAP) for a total of $3,936,188. During the program year, a total of 1,400 homes were weatherized, involving 1,241 children, 469 elderly people, and 423 individuals with disabilities. The state funds eight agencies across the state that accept applications for weatherization, assure the homes are eligible for the program, and either provide the services or contract them out.

Kansas has numerous opportunities to realize the significant benefits of energy efficiency and conservation. Utility customer service, state energy office programs, and private-sector energy service businesses could be developed to meet the needs of Kansas' consumers for education, home energy ratings, small business audits, and design services. Examples of successful programs exist in other states.

A low-interest loan program could assist individuals, businesses, units of local government, and educational institutions seeking to either improve the performance or buy down the cost of higher performance in new construction. The process should be simple to access and utilize a list of approved approaches for achieving savings.

Energy codes that have been adopted by the Kansas Legislature need to be enforced. Even where local communities have adopted energy codes, enforcement is sporadic. Home buyers and businesses expect their new building to be energy efficient, but only after receiving high utility bills do they discover their expectations have not been met. In addition, the energy performance of low-income housing needs to be improved. Rather than continuing to pay high utility bills month after month, the State should provide assistance in improving the energy performance of housing.

Energy and the Environment

> *"The most fundamental attribute of modern society is simply this: ours is a high energy civilization based largely on combustion of fossil fuels … Many of the key twentieth-century trends ... will continue during coming generations, but there will have to be some fundamental changes. The key reason for these adjustments is the necessity to minimize environmental impacts of energy use."*[11]

All energy production has environmental impacts. Fossil fuels—coal, oil, and natural gas—have driven our nation's and Kansas' economy in the last century.[12] This has not been without recognized costs to public health—emissions of nitrogen and sulfur oxides, mercury, and carbon dioxide, which are contributors to acid rain and global warming. Electrical generation from fossil fuels, primarily coal, is the single largest class of industrial pollution.[13] A number of proposals

[11] Vaclav Smil, *Energy at the Crossroads*, MIT Press, Cambridge, Mass (2003), p 1-3.
[12] Nuclear fission has also made a significant contribution and has its own unique security and environmental risks.
[13] Electric power plants were the number one toxic air polluter in North America, accounting for almost half of all industrial air emissions in 2001, according to the North American Commission on Environmental Cooperation

are under consideration at the federal level to impose fees or penalties on emissions. These proposals, if implemented, would affect the cost of energy and could make renewable energy sources more economically competitive.

Nuclear energy, which supplies about 20% of Kansas' electricity from one power plant at Wolf Creek in Coffey County, does not release carbon dioxide and other air pollutants, though it remains a controversial energy source for many. The federal government still has no long-term solution for disposal of high-level nuclear waste. For lower-level waste, Kansas belongs to an interstate compact commission that planned to bury it at a site in Nebraska. However, Nebraska unilaterally abrogated the agreement to take the waste, and the courts have ordered that state to return the funds collected from the compact member utilities. At this time, there is no effective long-term plan for disposal of low-level nuclear wastes from Kansas.

Renewable energy technologies also have environmental impacts, largely related to the production of the materials and the energy necessary to produce the structures that convert renewable resources to energy, as well as the energy and land required for their operation.[14] In Kansas, some have raised concerns about the development of wind energy in the Flint Hills; however, wind remains an excellent source of competitively priced, Kansas-produced renewable energy. Renewable energy in Kansas offers the potential for enormous energy export, particularly because of copious amounts of wind (rated first or third in wind resources among U.S. states). Renewable resources, such as wind and solar, are eminently sustainable. They won't degrade in time and can not be depleted like oil, gas, or coal. These energy resources provide a sustainable way to address Kansas' future power needs. Mixing them with current power sources will improve the diversity and robustness of our economy, and their relative cleanliness will improve public and ecological health.

Executive Order 2004-05 repeatedly calls for promoting the use of renewable energy resources and increasing the export of energy. These calls provide the basis for the development of a more balanced, sustainable, and environmentally friendly energy mix for Kansas. They provide the basis for a long-range Kansas Energy Plan. In a December 2001 review of the transition from fossil fuels to systems based predominantly on conversion of renewable energies in the 21st Century, *The Economist* says, "Gradualism is the key to doing this intelligently. The time to start is now … working without delay and with persistent commitment."[15]

Electric Utilities

In Kansas, as in the rest of the nation, electricity is provided by three types of utilities, distinguished by their ownership: investor-owned utilities, publicly owned utilities (in Kansas, these are all municipal owned and operated), and rural electric cooperatives (Figure 7).

Investor-owned utilities (IOUs) are operated by public corporations, and their stock is traded publicly and owned by shareholders. Kansas IOUs are regulated by the Kansas Corporation

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(CEC) report (Taking Stock 2001—North American Pollutant Releases and Transfers), released February 6, 2004 (http://www.cec.org/files/PDF/POLLUTANTS/TS2001-Report_en.pdf).

[14] U.S. Department of Energy, Energy Efficiency and Renewable Energy (EERE), 2003, Environmental Benefits and Impacts of Renwable Energy Technologies, April 2003.

[15] Smil, *ibid*, p 357.

Commission (KCC). IOUs are also subject to federal regulation by the Federal Energy Regulatory Commission (FERC). The IOUs operating in Kansas are Aquila, Empire District, Kansas City Power & Light, Southwestern Public Service Company, and Westar Energy. They provide electricity to roughly 68% of Kansas consumers.

Publicly owned, or municipal, utilities are customer-owned, not-for-profit public power systems. While there are various publicly owned models nationally, including public utility districts and federal power agencies, all Kansas publicly owned electric utilities are operated by a municipal government. Municipal utility rates are set by the city council, commission, or a representative municipal board. Some of the nation's largest cities—Los Angeles, San Antonio, Seattle, and Orlando—operate municipal utilities. In Kansas, these utilities range in size from the Kansas City Board of Public Utilities (serving nearly 67,000 customers and almost all of Wyandotte County) to the City of Radium, with just 23 customers. In 2004, 120 municipal electric utilities provided service to approximately 17% of the electric customers in the state.

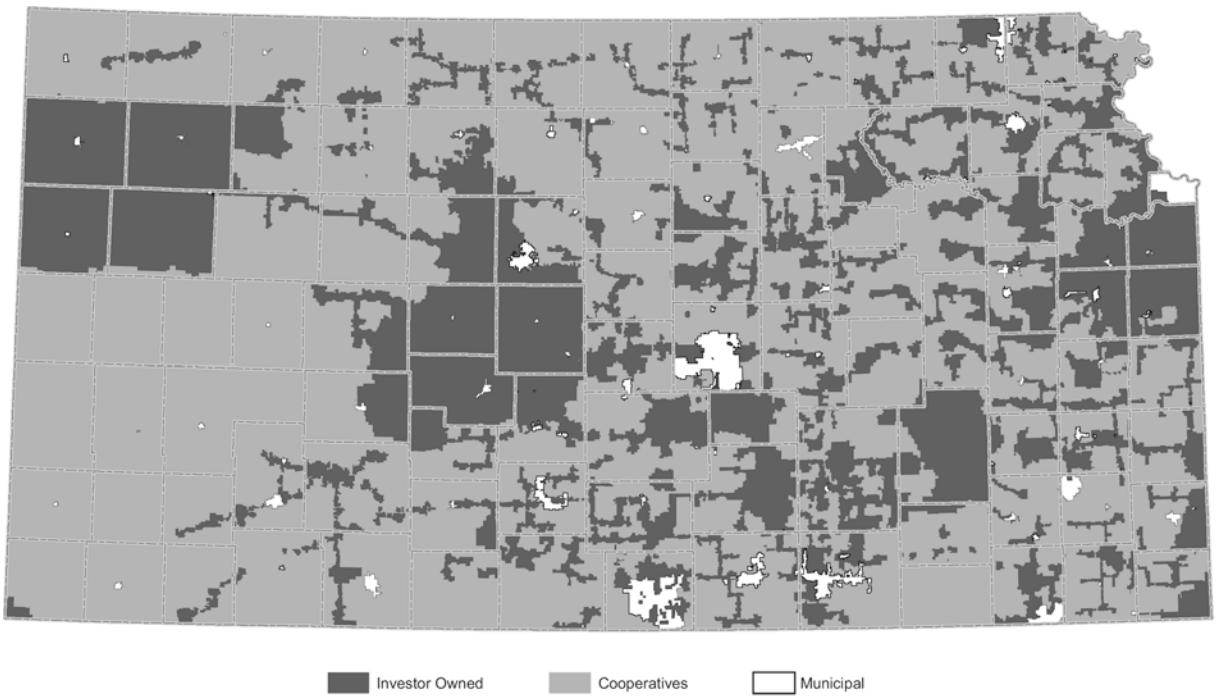

Figure 7—Areas covered by investor-owned, municipal, and cooperative utilities in Kansas (Kansas Corporation Commission).

Municipal utilities also account for approximately 18% of electricity sales in the state. A portion of this electricity is self-generated, with 63 of the 120 municipals owning and operating generating units. In most cases, however, municipal generation is designed to serve as "peaking units" that are used by the utilities to reduce the electric capacity purchased during peak load situations and also to reduce the energy purchased wholesale. The majority of the energy delivered by municipal electric utilities, also known as public power systems, is purchased on the wholesale market.

Rural electric cooperatives (RECs) are not-for-profit, member-owned electric utilities responsible for distributing power, typically to rural areas. Kansas RECs are governed by a board of trustees elected from the membership. Distribution cooperatives deliver electricity to the consumer. Generation and transmission cooperatives (G&Ts) generate and transmit electricity to distribution co-ops. Most Kansas RECs were set up under the Kansas Electric Cooperative Act, which, together with the federal Rural Electrification Act of 1934, made electric power available to rural customers who may not have received service because they were more costly to serve than the concentrated customers in urban areas. In Kansas, 28 distribution cooperatives and two G&Ts provide electricity to approximately 15% of Kansas consumers (Figure 8). The two G&Ts in Kansas are Sunflower Electric Power Corporation, based in Hays, and Kansas Electric Power Cooperative, Inc. (KEPCo), headquartered in Topeka.

A number of municipal utilities and rural electric cooperatives receive an allocation of renewable energy from federal hydropower projects. Electricity generated from hydropower dams in the western United States is delivered to Kansas communities over the transmission grid from the Western Area Power Administration (WAPA). Hydropower from dams to the southeast of Kansas is generated and delivered via the Southwestern Power Administration (SWPA).

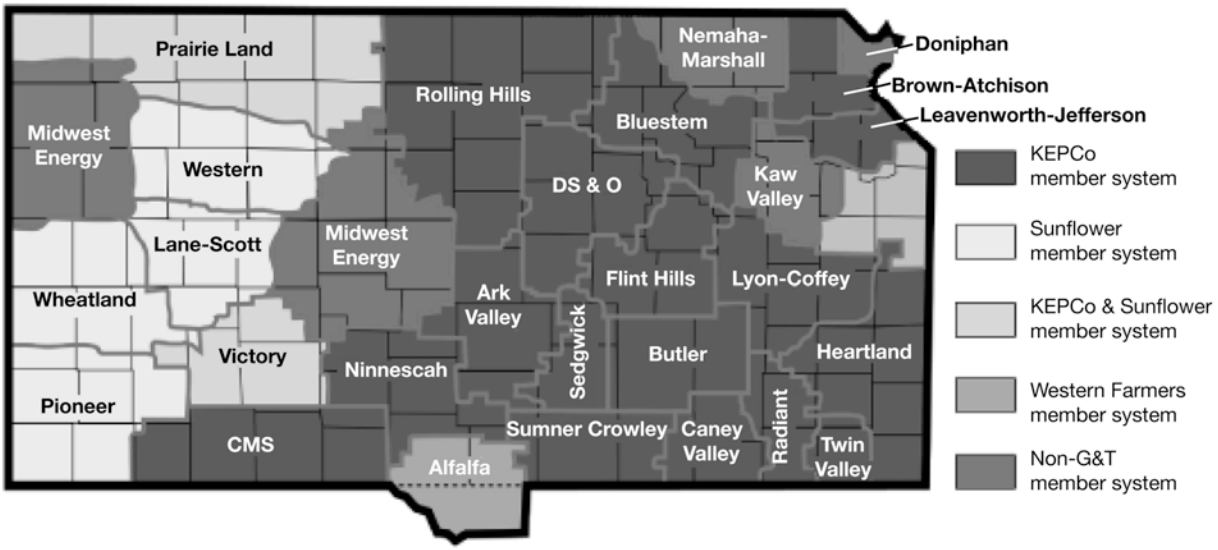

Figure 8—Service areas of Kansas electric cooperatives.

Many municipal electric utilities in the state also work through a joint action agency to coordinate energy purchases. Under the guidelines of K.S.A. 12-885, the Kansas Municipal Energy Agency (KMEA) was organized in 1980. KMEA is the state municipal joint action agency that serves its 69 member cities by purchasing and transmitting blocks of electricity for redistribution among individual cities.

Electric Transmission Issues

In recent years, the Federal Energy Regulatory Commission (FERC) has encouraged utilities to join Regional Transmission Organizations (RTOs) to govern the reliability of the transmission grid and create competitive markets for electricity. Most Kansas utilities are members of the Southwest Power Pool, an RTO covering parts of seven states, including Kansas. FERC approved the SPP RTO in October 2004.

The Cost Allocation Working Group (CAWG) is a task force within SPP that is drafting proposed rules for governing who will pay for new transmission in the future. The CAWG reports to the SPP Regional State Committee (RSC), a committee made up of public utility commissioners from the seven states involved in the RTO. Kansas Corporation Commissioner (and KEC Vice Chair) Brian Moline is the Kansas representative on the RSC.

The CAWG compromise proposal at this time is being debated between the utilities that rely on other companies' transmission lines (transmission-dependent utilities or TDUs) and the utilities that own their own transmission lines (principally investor-owned utilities or IOUs and G&Ts). Some believe this debate may result in two separate cost allocation proposals being forwarded to the SPP Board of Directors for consideration, although others are convinced that under no circumstances will SPP send two proposals to FERC.

One of the controversies with the move to form RTOs is the administrative cost associated with them. Numerous stakeholders (including municipals, co-ops, and IOUs) have objected to the rapidly escalating RTO costs, prompting the FERC to issue a Notice of Inquiry to investigate RTO costs, and the appropriate methodology for recording these costs.

The KCC has raised questions about the fiscal impacts of RTOs on utility customers. What had largely been local electric generation will increasingly be put into regional and national market competition. The possibility is raised that high-cost areas will buy up generation from low-cost areas, ultimately raising costs for the low-cost areas while lowering them for the high-cost areas. Kansas, with generation prices roughly in the middle range of costs nationwide, may be little affected in the near-term according to this scenario. However, Kansas ratepayers would ultimately be obligated to pay for their share of those costs associated with the new SPP RTO.

SPP also allocates expanded access to existing transmission lines and prioritizes construction of new lines. As of Fall 2004, SPP had requests for 7,330 MW of transmission capacity across the seven state region, of which 4,331 MW was to meet demands of wind energy projects. In Kansas alone, transmission requests totaled 2,843 MW, of which 1,943 MW, or 68%, was for wind energy demands.

Oil and Natural Gas

Natural gas and petroleum remain the dominant energy resources in Kansas (Figure 9), accounting for roughly 85% of the primary energy produced in the state.

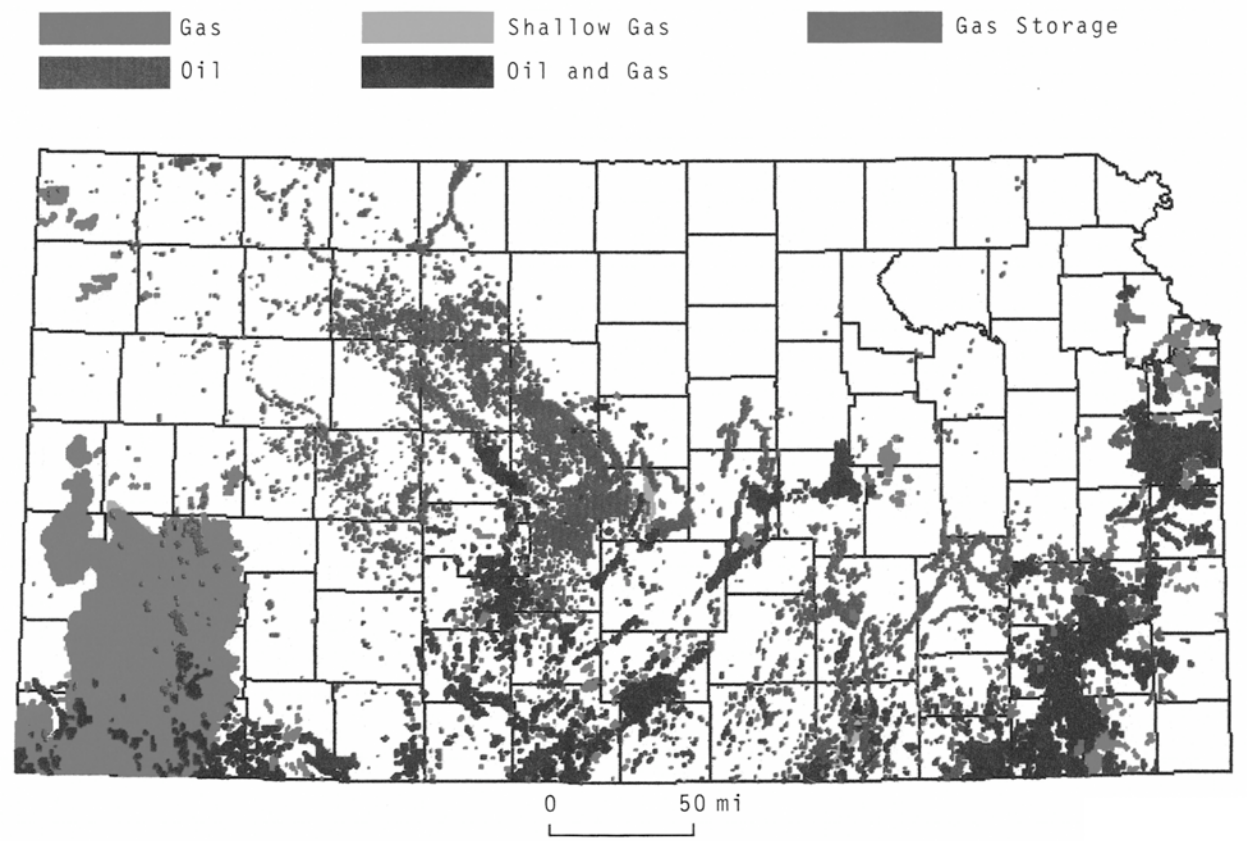

Figure 9—Oil and gas fields in Kansas (Kansas Geological Survey).

Higher prices for oil and natural gas are a two-edged sword in Kansas. They hurt consumer's pocketbooks and business's bottom lines. But higher oil and natural gas prices have spurred exploration and development among the state's oil and gas producers, and Kansas production has increased slightly in the last year or two (see Table 3). The value of oil and natural gas production in Kansas is projected to set a new record for 2004 in excess of $3.3 billion and may reach as much as $3.5 billion, substantially surpassing the previous record set in 2003 of just over $3 billion.

However, shortages of equipment and personnel shortages are limiting the ability of producers to drill new wells and enhance the production from existing wells. Demand for rotary rigs, workover rigs, and services far exceeds current supply. Operators often wait anywhere from six months to a year for a rotary rig, and some have not been able to receive services at all. Old rotary rigs are being reconditioned and put out to use, but the lack of an experienced labor force has slowed the potential growth in the state's oil industry.

KEC staff facilitated discussions among the state's petroleum companies, the recently-reorganized state office of Workforce Development, and the Kansas Board of Regents, about starting programs to train petroleum industry workers through community colleges.

Table 3—Kansas Oil and Gas Production and Number of Producing Wells, 1995–2004.
*Data for 2004 is incomplete.

Year	Oil		Gas	
	Production (bbls)	Wells	Production (mcf)	Wells
1995	45,514,231	42,843	735,197,372	15,425
1996	43,677,616	49,024	735,589,277	16,591
1997	41,289,423	47,041	691,101,383	16,742
1998	36,405,859	44,469	608,210,069	16,794
1999	33,995,317	41,409	567,689,934	16,792
2000	35,214,979	42,169	533,670,796	17,116
2001	34,123,809	41,488	486,982,154	17,552
2002	33,375,827	41,048	459,068,731	17,903
2003	33,961,910	40,850	423,030,488	18,376
2004*	22,643,286	39,912	270,151,433	18,632

Refineries—The state's three refineries, with a combined distillation capacity of more than 296 thousand barrels per day, are an integral part of the state's oil and gas industry, providing a nearby market for producers. These refineries—Coffeyville Resources, LLC, in Coffeyville, Frontier Refining & Marketing in El Dorado, and NCRA in McPherson—produce a range of finished petroleum products, including gasoline, diesel, and propane, as well as providing approximately 1,200 jobs.

Even with the loss of four refineries in the past 20 years, the state's refining capacity has remained steady through expansions and improvements. Today's refining capacity exceeds the state's petroleum consumption (which was about 202,380 barrels, or 8.5 million gallons per day).[16] Because Kansas oil production is about 93,000 barrels per day, refineries must import the majority of their crude oil (about 200,000 barrels) from outside the state. However, about 67,000 barrels per day of value-added, finished petroleum products can be exported out of state.

In recent years, the federal government has passed several environmental regulations, all dealing with the removal of sulfur from gasoline and distillate. The first of these, the Tier II Gasoline Sulfur Program, was signed into law on December 21, 1999, and requires refiners to reduce the sulfur content of all the gasoline they produce to an average of 30 parts per million (ppm) by January 1, 2006. The second piece of legislation, the Highway Diesel Sulfur Rule, requires that diesel fuel for use in highway vehicles have a sulfur content of no more than 15 ppm beginning June 1, 2006. The third regulation, signed into law May 11, 2004, is the Non-Road Diesel Rule, which will reduce sulfur levels in non-road fuels in two steps. Clearly, such regulations have a

[16] U.S. Department of Energy, EIA, 2004, Petroleum Profile—Kansas: http://tonto.eia.doe.gov/oog/info/state/ks.html.

tremendous financial impact on refiners here in Kansas and across the nation, as they invest in new equipment to meet the new requirements. It is estimated that the costs to modify the refineries is roughly equal to their current value.

Oil and gas pipelines—Kansas has an extensive network of crude oil, petroleum product, and liquefied petroleum gas pipelines. These pipelines connect producing areas with refining and storage facilities within the state also serving as a conduit for transporting gas from large reserves in Oklahoma and Texas to markets in the north and east. The new Kinder-Morgan natural gas pipeline from Colorado also ties into the southwestern Kansas and brings more supply into and through the state. A major natural gas liquids storage and transportation hub is located at Conway, just west of McPherson. In addition, Kansas has thousands of miles of pipelines for gathering natural gas.

Gasoline Marketers—According to the Kansas Department of Revenue, the state has 2,221 licensed gasoline stations, which are owned by 1,063 corporations (Table 4). Nearly 70% of these are operated by small business owners with one to ten stations. There are also approximately 550 licensed distributors (marketers) in Kansas, over 80% of which sell less than 3 million gallon of fuel per year. The national average for a marketer is around 20 million gallons per year. The number of small marketers in Kansas is consistent with the rural, agricultural profile of much of the state.

Table 4—Ownership of Kansas Gas Stations.

Number of Stores Owned	Number of Locations	Number of Companies
1 or 2 locations	1023	931
3–5 Locations	251	68
6–10 locations	277	39
More than 10 locations	670	25

Coalbed Methane

Drilling activity for coalbed methane (natural gas produced from coal seams) in Kansas continues to increase. Although data is still incomplete for 2004, the number of new wells is expected to exceed the 2003 total of 445. To date, a total of 1,763 coalbed methane wells have been drilled in eastern Kansas (Figure 10).

In Labette, Montgomery, Neosho, and Wilson counties, where coalbed methane development is currently concentrated, production continues to increase. Total production in 2004 will exceed 13.1 billion cubic feet (Bcf), and have a value at the wellhead of $72.2 million. This is up from production of 9.08 Bcf and a value of $44.3 million in 2003.

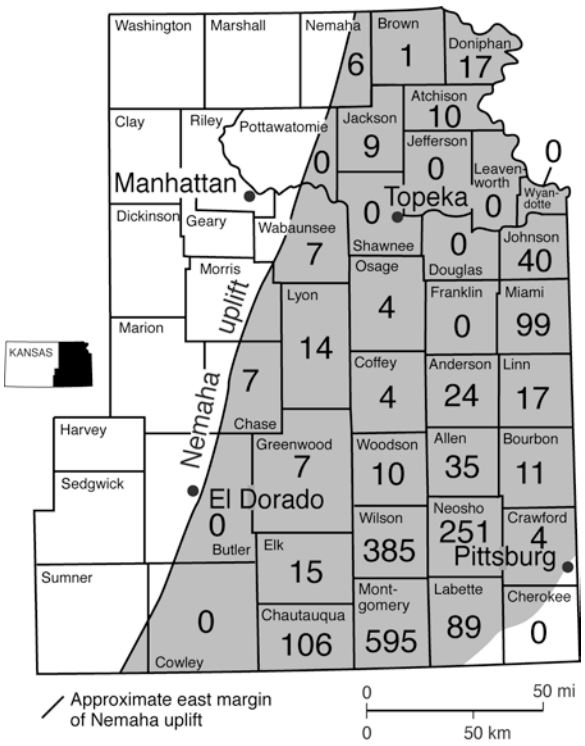

Figure 10—Total number of wells drilled in eastern Kansas counties, as of mid-2004.

Coalbed methane production has also been reported from adjacent counties and from Miami and Johnson counties. This rapid increase in production appears to be offsetting the decline in gas production from traditional gas reservoirs in southwest Kansas. As Table 3 indicates, while the number of producing oil wells has dropped significantly over the last decade, the number of gas wells has grown by more than 3,000.

Enhanced Oil Recovery and Linked Energy Systems

In the fall of 2004 scientists and engineers reported initial success in the experimental carbon dioxide enhanced oil recovery project near Russell, Kansas. Oil production of a few barrels per day resumed from a well that had not produced for many years. Confirmation of this technology holds tremendous potential to extend the life of declining oil fields by decades and add hundreds of millions of barrels to Kansas oil production.

Last year's energy report described how, on December 4, 2003, after more than four years of study and preparation, researchers from the University of Kansas and representatives of the state's oil industry began injecting carbon dioxide (CO_2) into a Russell County oil field. Researchers hoped that the CO_2, which comes from the U.S. Energy Partners ethanol plant near Russell, will flush out more oil, as has now been confirmed.

This technique, known as CO_2 Enhanced Oil Recovery (CO_2 EOR), involves pumping liquid CO_2 into a depleted oil reservoir about 3,000 feet underground. The CO_2 mixes with the remaining oil and pushes it to two nearby wells, where it can be pumped to the surface. Much of

the CO_2 will remain behind in the deep rock layers, permanently sequestered from the atmosphere and reducing greenhouse gas emissions, as more fully described below.

This joint industry-government-research project involves Murfin Drilling Co., Inc., and its partners John O. Farmer, Inc. and White Eagle Exploration, Inc.; Kinder-Morgan CO_2 Company, L.P.; U.S. Energy Partners, LLC; EPCO Carbon Dioxide, Inc.; U.S. Department of Energy; Kansas Department of Commerce; and the Kansas Geological Survey and Tertiary Oil Recovery Project, both part of the University of Kansas. Seed money was provided by the Kansas Technology Enterprise Corporation (KTEC).

Researchers are pumping about one truckload (about 20 tons) of CO_2 per day into the subsurface for about six months, then alternating injections of CO_2 with water, which will continue for the next four years. About half of the CO_2 comes back to the surface with the oil that is produced; the other half remains in the subsurface. In commercial-scale projects, the CO_2 would be separated from the produced oil and re-injected into the oil reservoir to start the process over again.

Because of the reservoir's geology, the results from the demonstration project were not known for many months and peak production as a result of CO_2 EOR may take a few years. If CO_2 EOR proves successful at the Russell site, researchers believe it has great potential at other sites around the state, resulting in the production of possibly hundreds of millions of barrels of additional oil over several decades.

In addition to its potential to dramatically boost the state's oil production, the project also could provide a way to capture and sequester CO_2 that otherwise would be released into the atmosphere. Because of the possible role of CO_2 in global climate change, such underground disposal, or sequestration is viewed as environmentally preferable. In the future, CO_2 emissions may be restricted by federal mandates, and electric utilities and other large CO_2 producers may be required to recover CO_2 from their flue gas and find alternatives, such as CO_2 sequestration, to venting it to the atmosphere.

The Russell demonstration project is also significant in its linking of the oil field project, the ethanol plant, and Russell's state-of-the-art power plant. In this linked energy system, waste heat from the electrical power plant is transferred to the ethanol plant, where it is used in the fermentation process of starches from locally grown grain. That fermentation produces ethanol, which is used as an additive in fuels (see previous discussion of ethanol). A byproduct of fermentation is CO_2, which is captured and trucked to the demonstration site for EOR.

Linked energy systems not only save energy, but also provide new revenue streams for each industry by turning byproducts into commodities. By creating business relationships between industries that historically have had little interaction, they pave the way for future innovative projects. The Russell demonstration project is the first time CO_2 from an ethanol plant has been used in this manner and the first CO_2 sequestration project of its kind.

Energy Council Activities in 2004

The Council got a revised set of marching orders in June, when Governor Sebelius issued Executive Order 2004-05 (Appendix 1), officially reconstituting the State Energy Resources Coordination Council (SERCC) as the Kansas Energy Council (KEC). The new KEC consists of 23 members (10 more than the previous SERCC membership) with the new members including four members from the Governor's Cabinet and Administration, representatives of the League of Municipalities and the Kansas Association of Counties, and members with expertise in renewable energy, energy efficiency, agriculture-related energy, and environmental issues (see Appendix 2 for full listing of Council members).

Since its formation in June, the new KEC met five times: July 22, August 30, September 20, October 19, and November 23, and identified a number of short- and long-term initiatives. Among the KEC's initiatives was the challenge to develop an incentives package for wind and other renewable energy to achieve the Governor's call for "full and aggressive development of renewable energy" in areas that are appropriate.

KEC received its first-ever budget of $150,000 for fiscal year 2005 (July 1, 2004, through June 30,2005). The funding was requested by the Kansas Corporation Commission as part of the state budget process, recommended by the Governor, and approved by the Legislature. KCC requested State General Funds as the funding mechanism, but eventually the monies came out of the KCC's assessment on the regulated utilities and petroleum industries, used for KCC operations. The KEC budget is managed by the Kansas Geological Survey at the University of Kansas under a contractual arrangement with KCC. No administrative or overhead fees are charged on the monies.

Standing committees within the Council were created for Petroleum, Utilities, and Renewable Energy. A Conservation & Efficiency Committee was proposed, which would work on issues cutting across all the standing committees. Discussions continue on how best to achieve this. An Executive Committee was formed, consisting of the KEC chair, vice-chair, and standing committee chairs. Among other duties, the Executive Committee reviews and approves the KEC budget and any changes to it on a quarterly basis.

KEC standing committees began work on additional short-term initiatives. The Utilities Committee reviewed other state's transmission options for possible adoption in Kansas. The Petroleum Committee discussed oil refining and marketing issues and developed recommendations to assist the downstream oil industry in addition to enhancing production. The Renewable Energy Committee began work on a roadmap for the development of renewable energy resources in the state, in preparation for the broader strategic planning effort scheduled for 2005.

The Council hosted a booth at the fifth annual state renewable energy conference on October 26 and 27 in Topeka. Council staff discussed the Tallgrass Prairie maps and distributed CDs of energy council reports and publications. KEC also gave its support to the Kansas Association for Conservation and Environmental Education (KACEE) Environmental Education Conference in

Dodge City, November 5 and 6, by sponsoring a field trip to the Gray County Wind Farm, near Montezuma. Additional energy-related activities are summarized in Appendix 2.

Wind and Prairie Task Force

Following the January 12th delivery of the Kansas Energy Plan 2004 to the Governor, Legislature, and Kansas Corporation Commission, the Council immediately began working with the Wind and Prairie Task Force (WPTF), established by the Council at the request of Governor Sebelius to find ways to help preserve Tallgrass Prairie and encourage wind-energy development under appropriate conditions. The task force was a temporary part of the larger, statewide energy planning and policy effort undertaken by the Council.

The task force was given the following formal charges:

1. identify and analyze relationships between areas of Tallgrass Prairie most appropriate for preservation and areas most appropriate or desired for wind development;
2. recommend guidelines, principles, and best practices to be utilized at the local level to help site wind-energy projects;
3. recommend voluntary guidelines or model agreements for land leases for wind-energy development;
4. recommend voluntary local siting guidelines for wind-energy development;
5. develop tools that can be used in the decision-making process to site wind-energy projects;
6. identify policies or authorizations needed by local government to address multi-county or regional issues;
7. review efforts for land trusts and other mechanisms to preserve the prairie; and
8. consider that wind energy in the Flint Hills cannot be viewed in isolation: anything the Task Force recommends may have application and be of value to other areas of the state.

Under the leadership of Co-chairs Jerry Karr and Jerry Lonergan, the WPTF met eight times from January through May, created three committees that met separately to address specific charges, and held two public forums in Manhattan and El Dorado in late April. In its final report to the Governor on June 7, WPTF members outlined two separate sets of options for dealing with wind-energy development in the Flint Hills, arbitrarily labeled Options A and B (WPTF, 2004). They also endorsed ten broad recommendations, all of which either have been implemented or are currently being addressed.

Flint Hills mapping project

One of the WPTF's recommendations was for better mapping of intact Tallgrass Prairie. In August the KEC initiated the Flint Hills mapping project. This project was undertaken by the Kansas Biological Survey and Kansas Geological Survey, in collaboration with a team of scientists from Kansas universities, agencies, and non-profit organizations. The project's goal was the creation of more detailed and accurate maps to assist Kansas policymakers as they consider development of natural resources in the Flint Hills and conservation of the nationally

important Tallgrass Prairie. The mapping team began with Chase and Morris counties and proceeded to the rest of the Flint Hills region, delineating areas of 90% or more intact prairie, 50% to 90% prairie, and areas of less than 50% prairie. Intact prairie consists of contiguous tracts of 2,000 acres or larger. Additional maps combine the prairie layers with a broad array of GIS layers that show topography, highways, and infrastructure such as transmission lines, oil and gas wells, and towers. The team presented their maps to the Council in mid-October; electronic versions are available at **www.kansasenergy.org/KEC/FHmaps.html** on the KEC web site.

In response to two other WPTF recommendations, the KEC adopted guidelines for landowners on leasing their lands for wind-energy development and guidelines to local governments for siting wind-energy projects. These guidelines were sent to county officials in the Flint Hills region and landowner groups, and are posted on the KEC web site **(www.kansasenergy.org).**

FutureGen

In March the Council sponsored an open forum to discuss the FutureGen project, and what it would take to bring it to Kansas. FutureGen is a federal initiative to design and build the world's first coal-fired, zero-emissions electricity power plant that also produces hydrogen and geologically sequesters carbon dioxide (CO_2). More than 30 representatives from industry, utilities, state and local government, and universities attended the meeting and were unanimous that Kansas should try to compete for this $1 billion, 10-year demonstration project. The plan requires formation of a national industrial consortium composed of a significant part of the nation's electric utilities and coal producers to plan, design, build, and operate the power plant. The consortium will be required to commit at least 20% of the project cost, or about $200–250 million.

The Council established the FutureGen Working Group to put together a bid to build FutureGen in Kansas. The Working Group is working with the U.S. Department of Energy (DOE) and Battelle Institute (manager for the industrial consortium expected to design, build, and operate FutureGen) to understand the factors to compete in the site selection process. The working group reported to the KEC in July that no action was expected until after the November election. Competition to host the FutureGen plant is intense, with numerous states vying to host the facility.

The initial timetable for the FutureGen project released by the DOE estimated that the site selection process would begin by October 2004. In anticipation of this, the Working Group collaborated with the Kansas Development Finance Authority to prepare legislative authorizing KDFA to issue bonds to finance the industry portion of the FutureGen or similar projects. Legislative leaders arranged for hearings, even though it was late in the session, and the bill passed with overwhelming support and was signed into law by Governor Sebelius. Subsequently, the Governor wrote Energy Secretary Spencer Abraham advising him of Kansas' strong interest in hosting the FutureGen plant in Kansas.

Energy Research and Development

Last year's energy report (SERCC, 2004) called for investigating potential for more energy-related research and development in Kansas. However, KEC did not have the time or resources to pursue this. KEC did endorse a resolution before the board of Kansas, Inc., for that body to

initiate an economic assessment of energy R&D in the state, expanding an earlier resolution focused solely on petroleum-related R&D. The board responded favorably to KEC's request; at the time of this report, one meeting had been held to look at possible research opportunities.

Energy Education

The KEC also agreed previously to undertake energy education activities, but again did not have time or resources to do this. Instead, the Council is trying to partner with existing energy educational programs. The KACEE activities were mentioned above. Another emerging partnership is with the Kansas Independent Oil and Gas Association (KIOGA) which is developing plans for a substantial educational program.

Online Resources

For the past two years, energy council materials were posted along with other energy information on the website **(www.kansasenergy.org)** managed by the University of Kansas Energy Research Center. All Council activities, schedules, minutes, reports, and reference materials are posted there.

In addition, the website is increasingly serving as a portal to other energy online resources. Of particular note is the Kansas Energy Information Network (KEIN). KEIN collects and posts daily news reports and other information on energy activities in Kansas or of particular interest to Kansas. KEIN has an extensive list of links to related web resources. KEIN is funded by a grant from the Kansas Corporation Commission State Energy Office.

Weekly Updates on Natural Gas Storage

KEC continued distributing via weekly email updates on the amount of natural gas in storage nationwide. These updates, prepared by Kansas Geological Survey scientist Dr. Timothy Carr, included the latest figures on natural gas in storage as well as Carr's interpretation of the data. The week reports with graphs are posted on the Kansas Energy Information Network page at **www.kansasenergy.org/kein.htm.**

Energy Forecasts

The following forecasts of the state's energy production and consumption are based on the latest available data.

Consumption Forecasts

As in the previous two years, Kansas energy consumption is expected to grow at just under 1.5% per year over the next five years (Figure 11). Details of the current forecasts are included in the tables in Appendix 3.

Kansas consumed 1,134 trillion Btu of energy in 2001, the last year of data from the U.S. Department of Energy, Energy Information Administration (see Figure 1). Petroleum products account for the largest share of the state's consumption, with coal (used almost exclusively for electrical generation) coming in a close second. Energy consumption in Kansas for 2005, 2007,

and 2009 is forecasted to be 1,222 trillion Btu, 1,258 trillion Btu, and 1,297 trillion Btu, respectively.

Total petroleum consumption is projected to increase by 2% per year during the forecast period. In 2005, 2007, and 2009, petroleum consumption is expected to be 84,535 thousand barrels, 88,239 thousand barrels, and 92,489 thousand barrels, respectively.

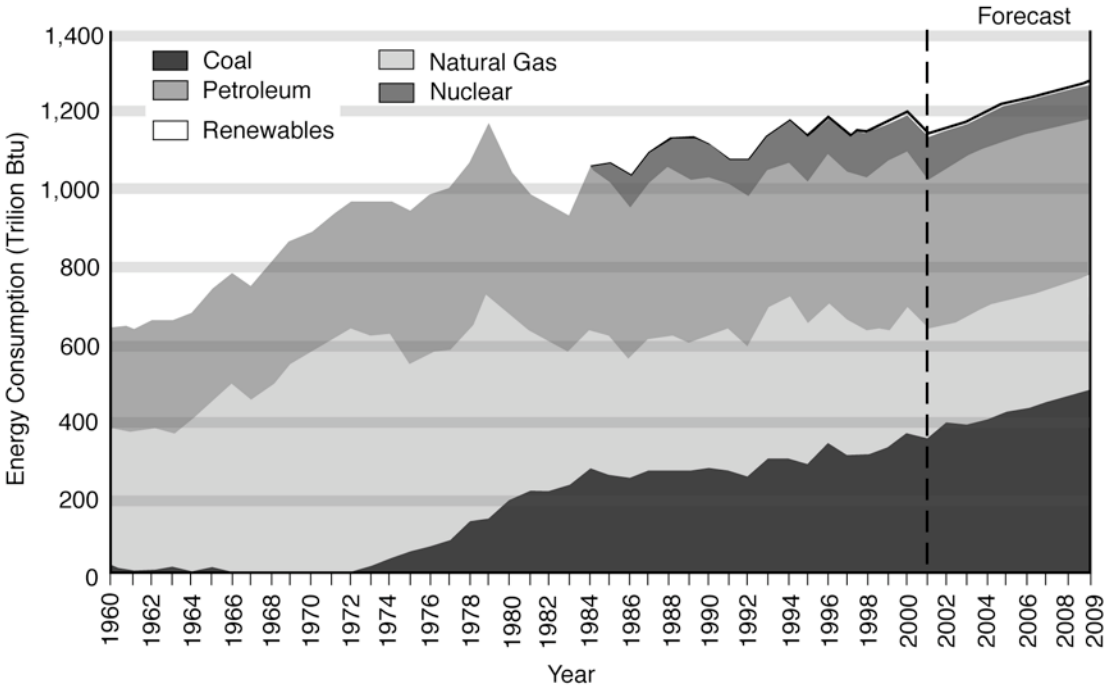

Figure 11—Kansas energy consumption, 1960 to 2003, with projections to 2009.

Continuing high prices are expected to cause a decline in natural gas consumption over the next five years. In 2002, the last year of data from the Department of Energy's Energy Information Administration (EIA), 239 billion cubic feet of natural gas was consumed in Kansas. In 2005, 2007, and 2009, the state's natural gas consumption is forecasted to be 251 billion cubic feet, 241 billion cubic feet, and 232 billion cubic feet, respectively.

Electricity consumption growth projections have not changed from those reported in 2004 (Appendix 3). Total electric consumption is predicted to grow by 2.7% through 2009. Kansas electricity consumption in 2005, 2007, and 2009 is projected to be 39,746 thousand megawatt-hours (MWh), 41,911 thousand MWh, and 44,199 thousand MWh, respectively.

Coal consumption is expected to increase through 2009. In 2002, 22,828 thousand short tons of coal were consumed in Kansas. By 2009, it is expected that 28,420 thousand short tons of coal will be consumed to meet the state's demand for electricity. These forecasts are based on the Kansas Corporation Commission's (KCC) projections for electric utility consumption, with the assumption that utilities account for 99% of Kansas coal consumption.

Production Forecasts

Energy production in Kansas is expected to increase slightly over the next 5 years (Figure 12). Total energy production is projected to be 730 trillion Btu, 738 trillion Btu, and 740 trillion Btu for the years 2005, 2007, and 2009, respectively.

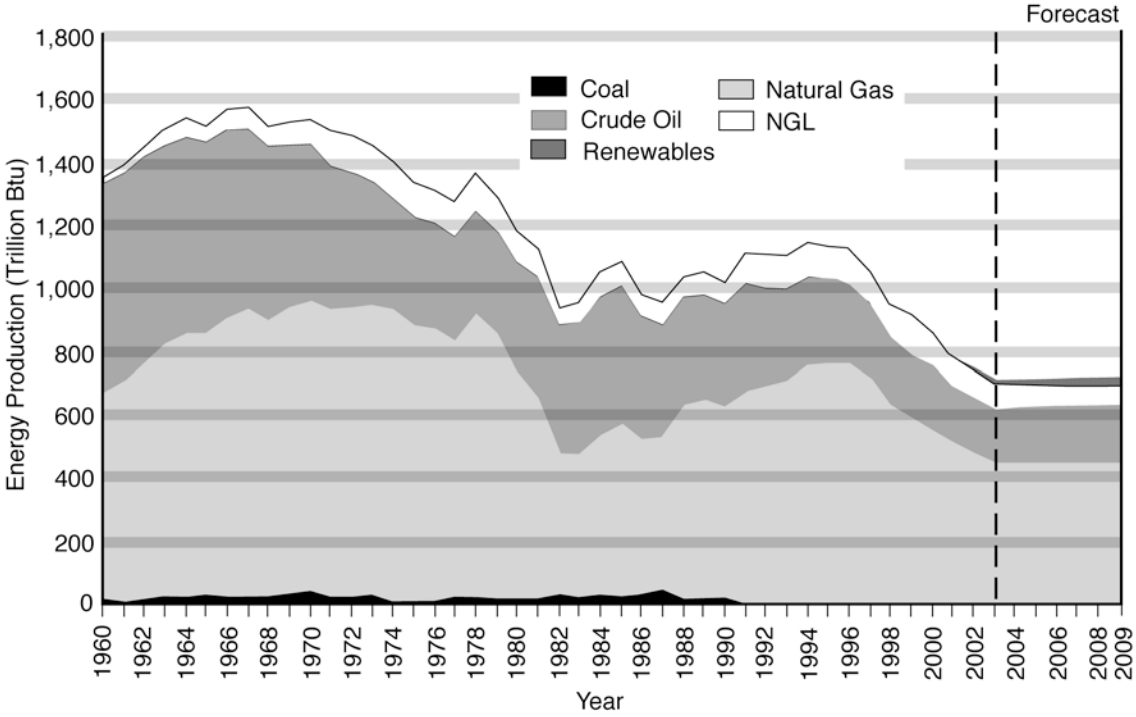

Figure 12—Kansas energy production, 1960 to 2003, with projections to 2009. Renewables includes ethanol, wind, and hydroelectric, as well as other renewable energy sources.

Oil—Monthly oil production in Kansas has continued to slowly increase and was just less than 3 million barrels per month in 2003. Production in Kansas has responded to the increase in prices and as long as the wellhead price remains above $20.00 per barrel, production should be stable. Whether production accelerates with prolonged prices of more than $40 per barrel is to be seen, though the price of oil will likely stay above $39 per barrel through 2004.

Kansas oil production in 2003 (last full year of data) was 33.9 million barrels of oil (BO). The forecasts for Kansas oil production in 2005, 2007, and 2009 are 34.25 million BO, 34.75 million BO, and 35 million BO, respectively.

In 2004, the wellhead value of Kansas oil production will exceed $1.2 billion and may approach $1.4 billion. This is an unprecedented value and should have a significant impact on the Kansas economy.

Natural Gas—Kansas gas production appears to have stabilized at approximately 35 billion cubic feet (Bcf) per month in response to increased prices through 2003 and 2004. Kansas gas production in 2004 should be approximately 410 Bcf, and may approach 420 Bcf, compared to

423 Bcf in 2003. This is the smallest annual decrease in production in the last decade and may represent a turning point in gas production. Natural gas production is forecasted to remain steady over the next five years.

The 2004 wellhead value of Kansas gas production will exceed $2.2 billion and may approach $2.4 billion, a record high value that should have a significant impact on the Kansas economy. Together, the value of oil and natural gas production in Kansas for 2004 will be in the range of $3.4 to $3.6 billion.

Electricity—Electricity generation is forecast to continue increasing over the next five years (Figure 13). Total generation is expected to increase from 46.7 million MWh in 2003, to 58.4 million MWh in 2009, a 25% increase for the period. Coal, fuel oil, and wind will fuel the majority of this increase. Electricity from wind will have the greatest percentage growth over this period, with an expected increase from 365 thousand MWh in 2003 to 1,928 thousand MWh in 2009. While wind's expected increase will account for just 13% of the total growth, it is expected to exceed that of fuel oil and natural gas. Forecasts assume the equivalent of four new 100-MW wind farms will be built during this period. Coal will provide the majority of growth.

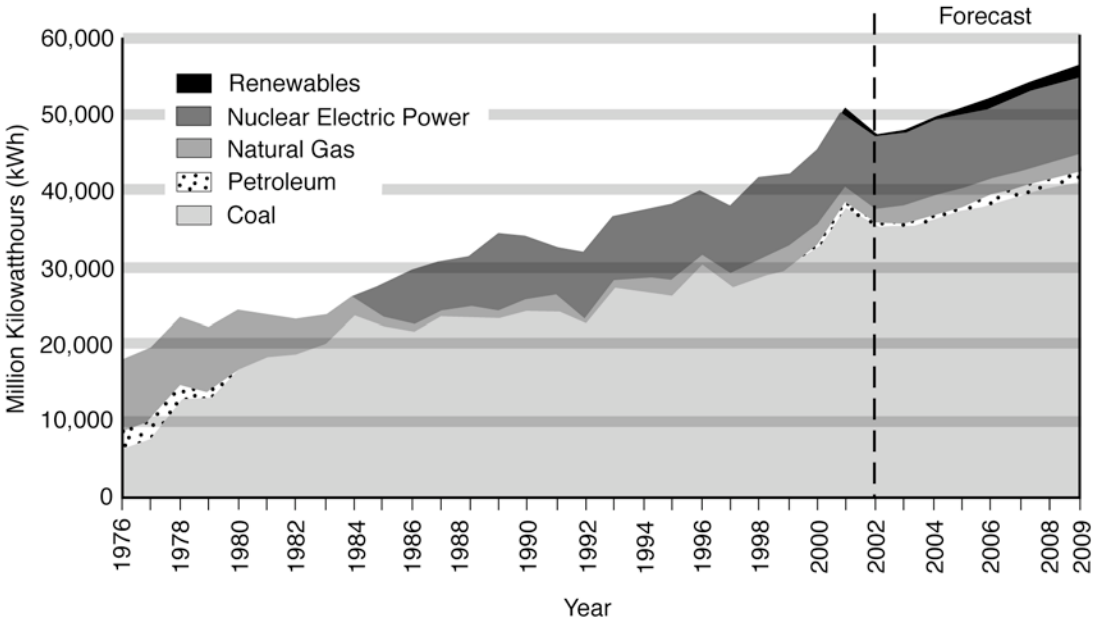

Figure 13— **Figure 13**—Kansas electrical generation, 1960 to 2002, with projections to 2009. Data through 2002 are from the U.S. Department of Energy, Energy Information Administration; data after 2002 are KEC forecasts.

Ethanol—One new ethanol plant came online during 2004. The Western Plains LLC ethanol plant in the Gove County town of Campus has a rated capacity of 25 million gallons per year (mmgy), with plans to expand by an additional 15 mmgy in 2005. The East Agri-Business ethanol plant in Garnett, Anderson County, began construction this year. This 35-mmgy ethanol plant will be online in 2005. Two more ethanol plants, one in Pratt and the other in Phillipsburg, are also expected to be online in 2005.

Ethanol production in Kansas is forecast to continue to grow, with total production nearly tripling by 2009. Production capacity in Kansas is around 120 million gallons in 2004. For the years 2005, 2007, and 2009, this capacity is expected to be near 192 million gallons, 300 million gallons, and 340 million gallons, respectively. In addition to the three ethanol plants expected to be online in the next year, the industry predicts two more plants will be built by 2009.

Recommendations Approved by the Kansas Energy Council for 2005

Overview

Following are recommendations for action approved by the Council during the year. A few were adopted as Council actions for the coming year. Others are recommendations for the Administration and Legislature to undertake.

Most of the actions were initially developed in the KEC Standing Committees and brought forward as committee recommendations to the full Council. The KEC chair introduced two items. Recommendations were approved by majority vote.

The KEC executive order (Appendix 1) requires the annual energy report to be submitted by the first day of the Legislative session each year. However, in order to allow more time for considering recommendations and drafting legislation, the Council decided to release the report in the third week of December 2004, ahead of the January 10, 2005, deadline. It is hoped this additional lead time will facilitate more effective implementation of many of the Council's recommendations.

Legislative Action

1. Amend Article 9 of the Uniform Commercial Code to restore a priority creditor status for sellers of oil and gas production when a purchaser is in bankruptcy. Such an amendment would follow the language of the former K.S.A. 84-9-319, which was repealed in 2000. *[approved 11 to 5]*

   Restoring priority creditor status to Kansas oil and gas producers in the event that the purchaser files for bankruptcy protection will remove a deterrent to exploration. With only a very limited number of purchasers of oil and gas production in Kansas (and, in the case of natural gas production, often only one possible purchaser), producers have a great deal of exposure in the event of a purchaser's bankruptcy. Purchasers are usually not willing to provide producers with a Letter of Credit. Obtaining a financially secure market for a purchaser's production will stimulate exploration and increased production of the state's oil and gas resources.

   The opponents to this action questioned whether it was an appropriate topic for the KEC to consider, asking whether it fell under the rubric of broad energy policy. However, the majority agreed that it would help achieve the KEC policy goal of extending the life of existing resources.

2. Authorize the Kansas Development Finance Authority (KDFA) to offer bonds to finance Kansas energy projects. *[approved unanimously]*

   Large wind energy projects in the U.S. have had to rely on financing principally from European sources, although domestic financing is becoming more available as lending institutions become more familiar with these projects. By offering state financing as an option, wind project developers will have greater certainty of finding financing for Kansas projects. This will also help keep financing costs low by offering a more competitive lending environment.

3. Remove mandatory labeling for 10% ethanol mixtures at the gas pump. Rescind Subsection b of Kansas Statute No. 79-3408, which currently requires that retail gasoline pumps with ethanol blends be labeled. *[approved 11 to 6]*

   The state requirement for a regulatory pump label for ethanol blended fuels, created in the 1970's, served its original purpose at a time when vehicles were less adaptable to the use of such fuels. Today all vehicles sold in the United States are warranted for the use of ethanol-blended fuels, plus most of the vehicles have fuel injected engines that use gasoline blends with detergents already added to the fuel. In the last decade over a trillion vehicle miles have been driven using ethanol-blended fuels without performance issues. Recently 11 states have removed their requirement for labeling of ethanol at the gas pump.

   Ethanol is the only gasoline component today required to be labeled at the pump, yet it is an environmentally beneficial component in gasoline that poses significantly less chemical risk than other components of the fuel mix. Removal of the labeling requirement will provide blenders and retailers flexibility for marketing ethanol blended fuels. Individual marketing and promotion labels by retailers would still be allowed and encouraged, but the legislative change would allow the retailers to make a marketing decision as to whether to use the label. It is estimated that the use of ethanol in fuels will at a minimum double in Kansas if the labeling requirement is removed.

   Opponents to this measure argued that the public is worried about the effects of ethanol on their engines and the signage is needed. Others argued that more consumers should have all the information about what they are buying. The majority view held that the engine problems with ethanol were two decades old and had been resolved. The mandated signage was in their view perpetuating the perception of a problem that no longer existed.

4. Adopt a $0.005/kwh production tax credit for new renewable energy facilities or expansions of existing facilities, including wind, hydro, solar, and biomass. This credit should be for the first 10 years of the facilities' operation, be tradable to allow benefit to non-taxable entities, and designed in such a way that it is transparent who claims these and how much they claim. *[approved, with 1 opposed]*

   Currently, the greatest incentive to wind energy production in the United States is the Production Tax Credit (PTC). Several other states have their own production incentives. Oklahoma offers a $0.005/kwh incentive for the first 10 years of

"zero-emission" facilities greater than 50 MW in size. Minnesota offers a 10-year, $0.015/kwh incentive for smaller hydro, wind, and biomass facilities (<2 MW). The Minnesota incentive is a cash payment, paid out of the state's Renewable Development Fund. New Mexico offers a $0.01/kwh incentive for 10 consecutive years of renewable energy projects larger than 10 MW. Such incentives can either make the state more attractive to develop renewable energy projects than neighboring states and/or help defer the costs of smaller projects, which may more easily fit into areas with constricted electrical transmission and which have higher costs due to the lack of scales of economy.

Tax credits only benefit taxable entities which have a sufficient state tax base. It difficult to track who claims these credits and how much they claim, due to the confidentiality of income tax statements. Having tradable tax credits that have a mechanism to make all trades and claims fully transparent is a way to allow non- and low-taxable entities to claim these credits AND to cut-down on potential fraud.

5. Adopt language clarifying that negotiations and discussions between wind-energy developers and local governments regarding voluntary payments for wind projects are legal. *[approved unanimously]*

   A court ruling in Butler County indicated that voluntary payments from wind developers to counties could not be considered during the zoning process, as it could be construed as a bribe. In lieu of paying property taxes, many wind developers offer these voluntary payments to be good corporate citizens, but the Butler County court ruling dampened such negotiations. Affirming the legality of the negotiation of these payments will let the "free market" decide what "voluntary" payment should be made.

Executive Action

1. Encourage producers and the Kansas Department of Revenue to study the advantages of changing the basis for the severance tax exemption on natural gas production from a dollar-based exemption level to a volume-based exemption level. *[approved unanimously]*

   The current Severance Tax exemption level for natural gas production exempts natural gas wells with a gross revenue below $87 per day from the Severance Tax calculated on a monthly basis. Contract pricing of natural gas production can change dramatically from month to month due to market forces. Thus, wells producing at relatively stable low-volume rates may, as a result of pricing swings, be exempt from severance tax one month, but not the next, which creates an administrative burden on the producer and the State of Kansas. Establishing a reasonable alternative production rate would ease administrative burden, while remaining revenue neutral to the State of Kansas.

   The original rationale for basing the Severance Tax exemption for natural gas production on a gross revenue basis was the existence of federal price controls on natural gas production. Most of the state's natural gas wells were still under

price control, which in some cases put a very low ceiling price on natural gas production from older wells. Other newer wells had much higher ceiling prices. A gross revenue approach was a reasonable approach at that time. However, federal price controls have long since terminated and determining an exemption for natural gas wells on a volume basis, similar to oil, would reduce administrative burden.

2. Encourage the Kansas Development Finance Authority (KDFA), as authority permits and as determined appropriate, to assist refiners and utilities in obtaining financing for refinery and utility modifications in compliance with EPA requirements. *[approved unanimously]*

   Refineries and utilities are of strategic importance to Kansas. The state's refineries create markets for Kansas oil production, maximizing its value while at the same time making refined products available at a relatively low cost to the consumers of Kansas. Utilities and refineries provide hundreds of jobs and have a direct economic benefit to the State. Recent EPA mandates will require extremely large capital expenditures by refiners to meet cleaner-burning fuel regulations.

3. Encourage the development of a Memorandum of Understanding to improve regulatory cooperation among appropriate state regulatory agencies and the U.S. Environmental Protection Agency in order to promote protection of the environment in a cost-effective manner, minimize regulatory duplication between the state and national levels of government, and increase efficiencies and communication for the "downstream" parts of the petroleum industry (i.e., refining and marketing). *[approved unanimously]*

   The objectives of the MOU are to: (1) provide long-term improvement in communication between the States and the EPA for the downstream petroleum industry; (2) institute a high-level relationship between the State and the EPA that will foster environmental protection based on mutual understanding of each other's mission, responsibilities, and authorities; (3) address issues that may result from concurrent jurisdiction between the State and EPA; (4) identify issues of concern between the State and the EPA, which then can be addressed in the short- and long-term; (5) discuss the need for and requirements pertaining to results-based environmental management plans relating to downstream oil and gas operations; and (6) create a permanent means of consultation as new issues emerge.

KEC Action

1. Direct a team to enact a study of the economic, environmental, and energetic effects associated with the enactment of a statewide Renewable Portfolio with Tradable Energy and Environmental Credits. *[approved unanimously]*

   A Renewable Portfolio Standard (RPS) is a policy that requires a prescribed percentage of electricity generation and/or capacity be from renewable energy sources, such as wind, biomass, solar, or hydro. Kansas-based renewable resources—if developed in a practical, prudent, and sustainable manner—could

potentially provide significant energy, economic, and environmental benefits for Kansas and the nation. Seventeen other states currently have some form of an RPS, including Iowa, Colorado, Minnesota, New York, and Texas.

Renewable Energy Credits (RECs), often used in conjunction with an RPS, are a mechanism for which electricity generated from renewable technologies are certified. These credits can be traded and/or sold on the open market both nationally and worldwide. RECs provide a means for renewable energy to be produced at the least cost, by allowing utilities to purchase credits at a cost less than the cost of producing the renewable power in their own service territory. The presence of RECs help ensure that the lowest cost resources get developed first, rather than forcing utilities.

2. Study the costs and benefits of implementing a public benefit fund to support strategic energy activities in Kansas, and options to fund it. *[approved unanimously]*

   Two general purposes for a PBF have been identified by the Renewable Incentives Committee report, the joint discussion of the Utilities and Renewables Committees, and previous discussions by the whole KEC. The main purpose is to provide a consistent revenue stream to fund various energy project activities that will meet the state's energy goals. The other purpose, of immediate importance, is to adequately fund the KEC to accomplish its work and program activities The KEC needs resources to answer the questions, do the background work, and provide the information that will enable the Council to wisely meet its charge and mission.

3. Develop a comprehensive, long-range strategic plan that includes tasks, resources, and intermediate steps necessary to meet the KEC objectives outlined in Executive Order 2004-05. This process would also involve determining what energy programs currently exist in state agencies and examining options for funding mechanisms for the KEC and other energy activities. *[previously approved]*

   The KEC (and SERCC) has been charged by executive order to develop a comprehensive statewide energy plan. The importance of such a plan to developing a robust state economy has been underscored by both the Statewide Economic Revitalization Plan and the Rural Life Task Force's report. Energy planning in Kansas is presently carried out in a piecemeal approach, driven by exigencies and initiatives among KEC members and others in state agencies. Strategic planning is the necessary first step towards development of a comprehensive, statewide energy plan.

4. Develop a comprehensive energy efficiency and conservation agenda for KEC and determine how it should be implemented. *[previously approved]*

   Energy efficiency and conservation can dramatically reduce energy consumption and are key components in moving Kansas towards energy self-sufficiency. To date, Kansas has ignored all but the most obvious and compelling opportunities for improving efficiency. We have the skills and technology to dramatically reduce the energy intensity of virtually every facet of our lives and economy, with

no loss of convenience or comfort. Maximizing energy efficiency must become an integral part of statewide energy policy.

Sources

Although much of the information contained in this report is referenced in the footnotes, the following background sources were also used and are listed here for additional information about energy in Kansas.

Brosius, Liz, and White, Scott, compilers, 2003, Kansas Energy Abstract: Kansas Geological Survey, Technical Series 18, 79 p.

KCC, 2004, Kansas Corporation Commission (KCC), State Energy Office, Facility Conservation Improvement Program (FCIP): http://www.kcc.state.ks.us/energy/fcip/index.htm.

KEC, 2004, Kansas Energy Council, Links to energy-related web sites and publications: http://kansasenergy.org/KEC/KEClinks.html.

KEIN, 2004, Kansas Energy Information Network: http://www.kansasenergy.org/kein.htm.

SERCC, 2003, Kansas Energy Plan 2003: Kansas Geological Survey, Open-file Report 2003-03, 46 p.

SERCC, 2004, Kansas Energy Plan 2004: Kansas Geological Survey, Open-file Report 2004-01, 48 p.

WPTF, 2004, Wind and Prairie Task Force, Final Report: Kansas Geological Survey, Open-file Report 2004-29, 55 p.

Appendix 1—Executive Order 2004-05

WHEREAS, article 1 §3 of the Constitution of the State of Kansas vests the supreme power of the state in the Governor; and

WHEREAS, energy production is one of the core foundations of our state's economy; and

WHEREAS, the production of energy benefits the long term economic and employment health of the state; and

WHEREAS, the formation of public policy is dependent upon accurate and timely information being made available to Kansas policy makers; and

WHEREAS, improved coordination of the state's energy resources is an essential element in improving the quality of services provided to the people of Kansas; and

WHEREAS, policies to encourage renewable energy and energy efficiency, and to extend the life of existing energy resources are required for Kansas to regain its status as an energy exporter and for Kansas' energy future; and

WHEREAS, surrounding states have taken steps to promote or mandate the use of renewable energy resources; and

WHEREAS, after decades of standing as a net energy exporter, Kansas has now become a net importer of energy; and

WHEREAS, Kansas has been ranked first among all states in harnessable renewable energy resources; and

WHEREAS, it is the goal to help ensure that Kansans have low cost, reliable and sustainable energy, produced in-state, to the fullest extent possible;

NOW THEREFORE, pursuant to the authority vested in me as Governor of the State of Kansas, I hereby reformulate the composition and mission of the State Energy Resources Coordination Council, from hereafter to be known as the Kansas Energy Council ("Council"), as summarized below.

1. The Council shall collect and compile information pertaining to the energy resources, including wind and biomass, in the state, as well as the availability, production and use of energy in the state;
2. Based on such data, the Council shall formulate and coordinate a comprehensive state energy plan that includes strategies to:
    a. Ensure a low-cost, reliable and sustainable energy supply;
    b. Increase energy efficiency and conservation;
    c. Develop a balanced renewable energy policy that promotes our state's renewable and alternative energy resources and preserves those natural ecosystems and places of scenic beauty that cannot be replaced;
    d. Extend the life of existing energy resources;
    e. Enhance energy related research and development; and
    f. Ensure an adequate and stable state energy infrastructure.
3. Such a state plan shall include sections corresponding with:
    a. Estimates of energy consumption by Kansas residents for the next 12,, 36 and 60 months by energy category; and
    b. Estimates of energy production by energy source for the next 12, 36, and 60 months by energy category.
4. The Council shall annually review and modify as necessary the state energy plan.
5. The Council shall advise of trends identified in relation to energy production, consumption and any tax or revenue implications.
6. The Council shall recommend:
    a. Appropriate means to increase the productive life of Kansas energy resources;
    b. Appropriate means to increase the state's self-reliance on its own energy sources through:

i. Increased efficiency in the use of its resources,
ii. Identification of potential energy resources, and
iii. Identification of policy and tax issues that positively or adversely impact self-reliance;

c. Ways to avoid loss of tax revenues and employment opportunities related to energy resource management;
d. Policies to increase the export of energy from Kansas;
e. Policies to encourage renewable energy development;
f. Policies to encourage energy efficiency; and
g. Such other policies or actions related to energy resource management as may be identified.

7. The Council shall study the state's transmission needs for electrical energy.
8. The Council shall determine ways to encourage energy-related production, research and development, and other energy-related economic development in the state.
9. The Council shall annually report their findings and recommendations to the Kansas Corporation Commission, the Governor and the Legislature no later than January 15th.
10. The Council shall consist of 23 members as follows:
    a. The state geologist, or designee;
    b. The chairperson of the Kansas Corporation Commission, or designee;
    c. The consumer counsel of the Citizens' Utility Ratepayer Board, or designee;
    d. 20 appointments by the Governor, including:
        i. An energy economist serving on the faculty of a state educational institution;
        ii. An individual knowledgeable in energy efficiency and conservation;
        iii. An individual knowledgeable in tax and revenue issues related to energy use or production;
        iv. An individual knowledgeable in energy production issues as they relate to agriculture;
        v. An individual knowledgeable in environmental issues related to energy use and production;
        vi. An individual knowledgeable in renewable energy resources;
        vii. A representative of oil producers;
        viii. A representative of natural gas producers;
        ix. A representative of refiners of petroleum products;
        x. A representative of marketers of petroleum products;
        xi. A representative of investor-owned generators of electricity;
        xii. A representative of rural electric cooperatives;
        xiii. A representative of municipally owned or operated electric utilities;
        xiv. A representative of generators of electricity from renewable energy resources;
        xv. A representative of Kansas Association of Counties;
        xvi. A representative of the League of Kansas Municipalities;
        xvii. The Secretary of Commerce, or designee;
        xviii. The Director of the Water Office, or designee;
        xix. The Secretary of Wildlife and Parks, or designee; and
        xx. The Secretary of Agriculture, or designee.
    e. Of the members first appointed by the Governor subsequent to this order, five shall serve terms of four years, five shall serve terms of three years and six shall serve terms of two years, and thereafter, terms shall be for four years;
    f. All other members shall serve terms consistent with their terms of office, employment or appointment.

11. The Governor shall annually select a chairperson and vice-chairperson from among the members. The Council may elect other officers among its members and may establish any committees deemed necessary to discharge its responsibilities.
12. Members of the Council shall not receive compensation, subsistence, allowance or associated expenses. Officers or employees of state agencies who are appointed to the Council as part of their duties shall be authorized to participate on the Council and may claim subsistence, allowance, mileage or associated expenses as permitted by law.

This order supercedes Executive Order No. 02-04. This document shall be filed with the Secretary of State as Executive Order No. 04-05, and shall become effective immediately.

Appendix 2—Kansas Energy Council: Members, Staff, Committees, and Working Groups

KEC Members

Name	Represents on KEC	Address	Phone/Fax	Email
Lee Allison KEC Chair	Office of the Governor	900 SW Jackson Ave Room 254 Topeka, KS 66612	785-296-6657 785-864-2002 785-296-3468-fax	lee.allison@gov.state.ks.us lallison@kgs.ku.edu
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Additional KEC Staff Activities

Testimony and formal presentations

Kansas House Utilities Committee, January 15, 2004, (invited testimony): The 2004 Kansas Energy Plan
Kansas Inc. Board Meeting, Topeka, Kansas, January 15, 2004: Economic Opportunities for Kansas Energy
Kansas Senate Utilities Committee, January 21, 2003, (invited testimony): The 2004 State Energy Plan
Wind and Prairie Task Force, Topeka, Kansas, January 23, 2004: Wind and the Kansas Energy Plan"
Desk & Derrick Club, Great Bend, Kansas, February 5, 2004: Kansas Energy Plan"
19th Annual Corrosion Control Seminar, National Association of Corrosion Engineers, Great Bend, Kansas, February 6, 2004: Natural Gas in Kansas
Kansas Municipal Utilities Annual Meeting, Wichita, Kansas, May 13, 2004: The Kansas State Energy Plan—Wind Energy, Transmission, FutureGen, and More
Rotary Club, Lawrence, Kansas, June 7, 2004: Kansas Energy

KSU Geology Alumni Annual Meeting, Manhattan, Kansas, October 14, 2004: Current Challenges in Kansas Energy

National Association of Gas Consumers, Branson, Missouri, October 21: Coalbed methane in the U.S.

Kansas Renewable Energy and Efficiency Conference, Topeka, Kansas, October 26, 2004: Kansas Energy Developments

Publications

SERCC, 2004, Kansas Energy Plan 2004, State Energy Resources Coordination Council: Kansas Geological Survey, Open-file Report 2004-1, 48 p.

WPTF, 2004, Wind and Prairie Task Force, State Energy Resources Coordination Council: Kansas Geological Survey, Open-file Report 2004-29, 55 p.

News media

Council staff conducted more than 40 interviews with local, statewide, and national news media on a variety of Kansas energy issues.

Appendix 3—Summary Tables for Consumption Forecasts

The consumption forecasts were developed in a three-step process. First, the historical annual growth rate of the energy consumption was calculated. To ensure stability in historical growth rates, outliers (anomalies in the data) were deleted throughout the data-filtering process. Second, the historical data were divided into two different sizes, a full sample and a truncated sample. The full sample incorporates all available historical data, whereas the truncated sample utilizes only the recent consumption data. More recent history is considered a better barometer for the future, especially considering some of the structural changes that have occurred recently in the energy markets. Finally, the historical data were modeled and projected into the future. A number of statistical techniques were utilized, including both static (actual values) and dynamic (previously forecasted) models.

Table A1—Summary of Kansas petroleum products consumption, 1990 to 2001, with projections to 2017 (thousands of barrels). Historical production data (through 2001) are from U.S. Department of Energy, Energy Information Administration. Note: 1999 value for kerosene consumption is estimated.

Year	Total Petroleum Products Consumption Forecast	Percent Change	LPG Consumption Forecast	Percent Change	Kerosene Consumption Forecast	Percent Change	Distillate Consumption Forecast	Percent Change	Gasoline Consumption Forecast	Percent Change	Residual Fuel Consumption Forecast	Percent Change
1990	77, 702		15,565		27		16,697		28,627		229	
1991	71,152	-8.4%	13,293	-14.6%	25	-7.4%	15,624	-6.4%	28,041	-2.0%	128	-44.1%
1992	75,302	5.8%	16,816	26.5%	32	28.0%	14,895	-4.7%	27,821	-0.8%	178	39.1%
1993	67,099	-10.9%	8,269	-50.8%	37	15.6%	16,016	7.5%	28,480	2.4%	369	107.3%
1994	65,725	-2.0%	7,754	-6.2%	18	-51.4%	14,687	-8.3%	29,073	2.1%	187	-49.3%
1995	65,939	0.3%	4,924	-36.5%	29	61.1%	18,223	24.1%	29,402	1.1%	31	-83.4%
1996	72,912	10.6%	10,422	111.7%	37	27.6%	16,570	-9.1%	30,927	5.2%	289	832.3%
1997	75,567	3.6%	14,557	39.7%	59	59.5%	16,375	-1.2%	30,696	-0.7%	257	-11.0%
1998	75,831	0.3%	14,121	-3.0%	50	-15.3%	15,930	-2.7%	32,001	4.3%	269	4.7%
1999	86,287	13.8%	21,741	54.0%	36	-28.0%	15,660	-1.7%	33,550	4.8%	570	111.9%
2000	79,321	-8.1%	17,401	-20.0%	36	0.0%	14,849	-5.2%	31,894	-4.9%	937	64.4%
2001	73,907	-6.8%	11,122	-36.1%	41	13.9%	15,550	4.7%	30,297	-5.0%	1,301	38.8%
2002	79,855	8.0%	18,636	67.6%	39	-4.5%	15,462	-0.6%	30,245	-0.2%	1,328	2.1%
2003	81,308	1.8%	19,960	7.1%	37	-4.5%	15,375	-0.6%	30,193	-0.2%	1,356	2.1%
2004	82,866	1.9%	21,377	7.1%	36	-4.5%	15,288	-0.6%	30,140	-0.2%	1,385	2.1%
2005	84,535	2.0%	22,895	7.1%	34	-4.5%	15,202	-0.6%	30,089	-0.2%	1,414	2.1%
2006	86,323	2.1%	24,520	7.1%	33	-4.5%	15,116	-0.6%	30,037	-0.2%	1,444	2.1%
2007	88,239	2.2%	26,261	7.1%	31	-4.5%	15,030	-0.6%	29,985	-0.2%	1,475	2.1%
2008	90,291	2.3%	28,126	7.1%	30	-4.5%	14,945	-0.6%	29,933	-0.2%	1,506	2.1%
2009	92,489	2.4%	30,122	7.1%	28	-4.5%	14,861	-0.6%	29,881	-0.2%	1,537	2.1%
2010	94,841	2.5%	32,261	7.1%	27	-4.5%	14,777	-0.6%	29,830	-0.2%	1,570	2.1%
2011	97,360	2.7%	34,552	7.1%	26	-4.5%	14,693	-0.6%	29,778	-0.2%	1,603	2.1%
2012	100,057	2.8%	37,005	7.1%	25	-4.5%	14,610	-0.6%	29,727	-0.2%	1,637	2.1%
2013	102,943	2.9%	39,632	7.1%	24	-4.5%	14,528	-0.6%	29,676	-0.2%	1,671	2.1%
2014	106,032	3.0%	42,446	7.1%	23	-4.5%	14,446	-0.6%	29,625	-0.2%	1,706	2.1%
2015	109,338	3.1%	45,460	7.1%	22	-4.5%	14,364	-0.6%	29,574	-0.2%	1,742	2.1%
2016	112,876	3.2%	48,687	7.1%	21	-4.5%	14,283	-0.6%	29,523	-0.2%	1,779	2.1%
2017	116,529	3.2%	52,144	7.1%	20	-4.5%	14,202	-0.6%	29,472	-0.2%	1,817	2.1%

Table A1, continued.

Year	Petroleum Lubricants Consumption Forecast	Percent Change	Asphalt Consumption Forecast	Percent Change	Aviation Gasoline Consumption Forecast	Percent Change	Aviation Jet Fuel Consumption Forecast	Percent Change	Other Pet Prods Consumption Forecast	Percent Change
1990	1,036		3,875		136		3,701		7,809	
1991	927	-10.5%	3,721	-4.0%	124	-8.8%	3,296	-10.9%	5,973	-23.5%
1992	944	1.8%	3,715	-0.2%	142	14.5%	4,164	26.3%	6,595	10.4%
1993	962	1.9%	3,635	-2.2%	151	6.3%	3,617	-13.1%	5,563	-15.6%
1994	1,005	4.5%	4,741	30.4%	142	-6.0%	1,981	-45.2%	6,137	10.3%
1995	987	-1.8%	3,911	-17.5%	146	2.8%	2,414	21.9%	5,872	-4.3%
1996	959	-2.8%	3,581	-8.4%	177	21.2%	2,009	-16.8%	7,941	35.2%
1997	1,012	5.5%	2,115	-40.9%	247	39.5%	2,130	6.0%	8,119	2.2%
1998	1,061	4.8%	2,699	27.6%	199	-19.4%	2,157	1.3%	7,344	-9.5%
1999	1,071	0.9%	2,358	-12.6%	240	20.6%	3,476	61.1%	7,585	3.3%
2000	1,055	-1.5%	2,470	4.7%	215	-10.4%	3,234	-7.0%	7,230	-4.7%
2001	967	-8.3%	4,157	68.3%	196	-8.8%	2,259	-30.1%	8,017	10.9%
2002	962	-0.5%	2,527	-39.2%	196	0.2%	2,386	5.6%	8,073	0.7%
2003	957	-0.5%	2,585	2.3%	197	0.2%	2,519	5.6%	8,130	0.7%
2004	951	-0.5%	2,644	2.3%	197	0.2%	2,660	5.6%	8,187	0.7%
2005	946	-0.5%	2,705	2.3%	198	0.2%	2,809	5.6%	8,244	0.7%
2006	941	-0.5%	2,767	2.3%	198	0.2%	2,966	5.6%	8,302	0.7%
2007	936	-0.5%	2,831	2.3%	198	0.2%	3,133	5.6%	8,360	0.7%
2008	931	-0.5%	2,896	2.3%	199	0.2%	3,308	5.6%	8,418	0.7%
2009	926	-0.5%	2,963	2.3%	199	0.2%	3,493	5.6%	8,477	0.7%
2010	921	-0.5%	3,031	2.3%	200	0.2%	3,689	5.6%	8,536	0.7%
2011	916	-0.5%	3,101	2.3%	200	0.2%	3,895	5.6%	8,596	0.7%
2012	911	-0.5%	3,172	2.3%	200	0.2%	4,114	5.6%	8,656	0.7%
2013	906	-0.5%	3,245	2.3%	201	0.2%	4,344	5.6%	8,717	0.7%
2014	901	-0.5%	3,320	2.3%	201	0.2%	4,587	5.6%	8,778	0.7%
2015	896	-0.5%	3,396	2.3%	202	0.2%	4,844	5.6%	8,839	0.7%
2016	891	-0.5%	3,474	2.3%	202	0.2%	5,115	5.6%	8,901	0.7%
2017	886	-0.5%	3,554	2.3%	202	0.2%	5,402	5.6%	8,964	0.7%

Table A2—Summary of Kansas natural gas consumption, 1990 to 2002, with projections to 2017(thousand mcf). Historical production data (through 2001) are from U.S. Department of Energy, Energy Information Administration. *Fuel consumption forecast includes fuel delivery losses, which comprise lease fuel, pipeline fuel, and plant fuel; these losses were assumed to grow 2.5% per year throughout the forecast period.

Year	Kansas Total Gas Consumption Forecast	Percent Change	Residential Consumption Forecast	Percent Change	Commercial Consumption Forecast	Percent Change	Industrial Consumption Forecast	Percent Change	Utility Consumption Forecast	Percent Change	Fuel Consumption Forecast*	Percent Change
1990	352,779		71,327		56,045		116,915		26,978		81,514	
1991	370,557	5.0%	74,825	4.9%	58,571	4.5%	123,517	5.6%	36,122	33.9%	77,522	-4.9%
1992	343,217	-7.4%	71,522	-4.4%	53,973	-7.8%	130,807	5.9%	13,981	-61.3%	72,933	-5.9%
1993	391,605	14.1%	84,896	18.7%	56,023	3.8%	139,032	6.3%	21,636	54.7%	90,019	23.4%
1994	418,017	6.7%	74,156	-12.7%	52,253	-6.7%	187,979	35.2%	27,279	26.1%	76,350	-15.2%
1995	368,341	-11.9%	75,846	2.3%	53,122	1.7%	129,515	-31.1%	27,945	2.4%	81,914	7.3%
1996	362,964	-1.5%	85,376	12.6%	57,229	7.7%	110,294	-14.8%	22,607	-19.1%	87,458	6.8%
1997	339,196	-6.5%	69,415	-18.7%	41,483	-27.5%	115,552	4.8%	25,822	14.2%	86,921	-0.6%
1998	326,674	-3.7%	70,217	1.2%	41,788	0.7%	110,881	-4.0%	36,894	42.9%	66,894	-23.0%
1999	302,932	-7.3%	68,146	-2.9%	38,952	-6.8%	97,254	-12.3%	35,890	-2.7%	62,690	-6.3%
2000	312,369	3.1%	70,601	3.6%	40,297	3.5%	108,625	11.7%	33,509	-6.6%	59,338	-5.3%
2001	272,500	-12.8%	70,182	-0.6%	37,560	-6.8%	93,351	-14.1%	23,267	-30.6%	48,141	-18.9%
2002	304,993	11.9%	70,858	1.0%	38,752	3.2%	108,038	15.7%	21,389	-8.1%	65,956	37.0%
2003	295,728	-3.0%	70,540	-0.4%	37,875	-2.3%	103,998	-3.7%	15,711	-26.5%	67,605	2.5%
2004	285,609	-3.4%	70,468	-0.1%	37,660	-0.6%	94,812	-8.8%	16,760	6.7%	65,910	-2.5%
2005	294,311	3.0%	70,396	-0.1%	37,446	-0.6%	95,551	0.8%	23,000	37.2%	67,918	3.0%
2006	296,914	0.9%	70,324	-0.1%	37,233	-0.6%	96,297	0.8%	24,541	6.7%	68,519	0.9%
2007	299,659	0.9%	70,253	-0.1%	37,022	-0.6%	97,047	0.8%	26,185	6.7%	69,152	0.9%
2008	302,558	1.0%	70,181	-0.1%	36,812	-0.6%	97,804	0.8%	27,940	6.7%	69,821	1.0%
2009	305,618	1.0%	70,110	-0.1%	36,603	-0.6%	98,567	0.8%	29,812	6.7%	70,527	1.0%
2010	308,851	1.1%	70,038	-0.1%	36,395	-0.6%	99,335	0.8%	31,809	6.7%	71,273	1.1%
2011	312,267	1.1%	69,967	-0.1%	36,188	-0.6%	100,110	0.8%	33,940	6.7%	72,062	1.1%
2012	315,878	1.2%	69,896	-0.1%	35,983	-0.6%	100,891	0.8%	36,214	6.7%	72,895	1.2%
2013	319,697	1.2%	69,824	-0.1%	35,779	-0.6%	101,677	0.8%	38,641	6.7%	73,776	1.2%
2014	323,737	1.3%	69,753	-0.1%	35,575	-0.6%	102,470	0.8%	41,229	6.7%	74,709	1.3%
2015	328,012	1.3%	69,682	-0.1%	35,374	-0.6%	103,269	0.8%	43,992	6.7%	75,695	1.3%
2016	332,537	1.4%	69,611	-0.1%	35,173	-0.6%	104,075	0.8%	46,939	6.7%	76,739	1.4%
2017	337,329	1.4%	69,540	-0.1%	34,973	-0.6%	104,886	0.8%	50,084	6.7%	77,845	1.4%

Table A3—Summary of Kansas electricity consumption, 1990 to 2002, with projections to 2017 (thousands of barrels). Historical production data (through 2002) are from U.S. Department of Energy, Energy Information Administration.

Year	Kansas Total Gas Consumption Forecast	Percent Change	Residential Consumption Forecast	Percent Change	Commercial Consumption Forecast	Percent Change	Industrial Consumption Forecast	Percent Change	Other Consumption Forecast	Percent Change
1990	27,149		9,515		9,169		8,087		378	
1991	28,152	3.7%	9,933	4.4%	9,551	4.2%	8,284	2.4%	384	1.7%
1992	27,069	-3.8%	8,873	-10.7%	9,400	-1.6%	8,451	2.0%	346	-10.0%
1993	28,808	6.4%	9,986	12.5%	9,753	3.8%	8,702	3.0%	367	6.0%
1994	29,614	2.8%	10,131	1.4%	10,111	3.7%	9,001	3.4%	371	1.3%
1995	30,357	2.5%	10,356	2.2%	10,273	1.6%	9,356	3.9%	372	0.1%
1996	31,291	3.1%	10,672	3.1%	11,005	7.1%	9,231	-1.3%	383	3.0%
1997	32,270	3.1%	10,862	1.8%	11,424	3.8%	9,365	1.5%	618	61.5%
1998	34,140	5.8%	11,832	8.9%	12,073	5.7%	9,762	4.2%	473	-23.5%
1999	33,820	-0.9%	11,347	-4.1%	11,822	-2.1%	10,215	4.6%	436	-7.8%
2000	35,921	6.2%	12,528	10.4%	12,511	5.8%	10,222	0.1%	660	51.3%
2001	35,847	-0.2%	12,062	-3.7%	12,787	2.2%	10,569	3.4%	429	-35.0%
2002	36,713	2.4%	12,745	5.7%	13,392	4.7%	10,195	-3.5%	381	-11.2%
2003	37,665	2.6%	13,064	2.5%	13,815	3.2%	10,392	1.9%	393	3.3%
2004	38,648	2.6%	13,391	2.5%	14,257	3.2%	10,593	1.9%	406	3.3%
2005	39,657	2.6%	13,726	2.5%	14,713	3.2%	10,798	1.9%	419	3.3%
2006	40,693	2.6%	14,069	2.5%	15,184	3.2%	11,007	1.9%	433	3.3%
2007	41,758	2.6%	14,421	2.5%	15,670	3.2%	11,220	1.9%	447	3.3%
2008	42,852	2.6%	14,781	2.5%	16,171	3.2%	11,438	1.9%	462	3.3%
2009	43,975	2.6%	15,151	2.5%	16,689	3.2%	11,659	1.9%	477	3.3%
2010	45,129	2.6%	15,529	2.5%	17,223	3.2%	11,885	1.9%	492	3.3%
2011	46,315	2.6%	15,918	2.5%	17,774	3.2%	12,115	1.9%	508	3.3%
2012	47,532	2.6%	16,315	2.5%	18,343	3.2%	12,349	1.9%	525	3.3%
2013	48,783	2.6%	16,723	2.5%	18,930	3.2%	12,588	1.9%	542	3.3%
2014	50,068	2.6%	17,141	2.5%	19,536	3.2%	12,832	1.9%	560	3.3%
2015	51,389	2.6%	17,570	2.5%	20,161	3.2%	13,080	1.9%	578	3.3%
2016	52,745	2.6%	18,009	2.5%	20,806	3.2%	13,333	1.9%	597	3.3%
2017	54,138	2.6%	18,459	2.5%	21,472	3.2%	13,591	1.9%	616	3.3%